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ABSTRACT

The activities in this volume of practical mathematics are intended for the intermediate grades. The manual contains three components which can be structured in different combinations according to different student needs. Built around a review of selected objectives in the mathematics basic curriculum, the material is intended to stimulate interest in both mathematics and the professional world. The first section of each component revolves around challenging and fun problems; the second section deals with practical aspects of math in everyday life; and the third component presents math problems similar to those students will encounter in contemporary life. The activities contain narratives, puzzles, games, and other activities of high interest and low readability. Each section is introduced by a statement of learning objectives, the cognitive and affective domains and levels concerned, materials, key words, and guidelines for implementation. Each section also contains an exercise that is applied to home and community. The student activities include exercises and evaluations based on the mathematical skill reviewed. The skills and life situations dealt with in this volume are the four mathematical operations in the context of transportation, computer area and perimeter in relation to a career goal, and simple interest problems and the role of technology. (AMH)

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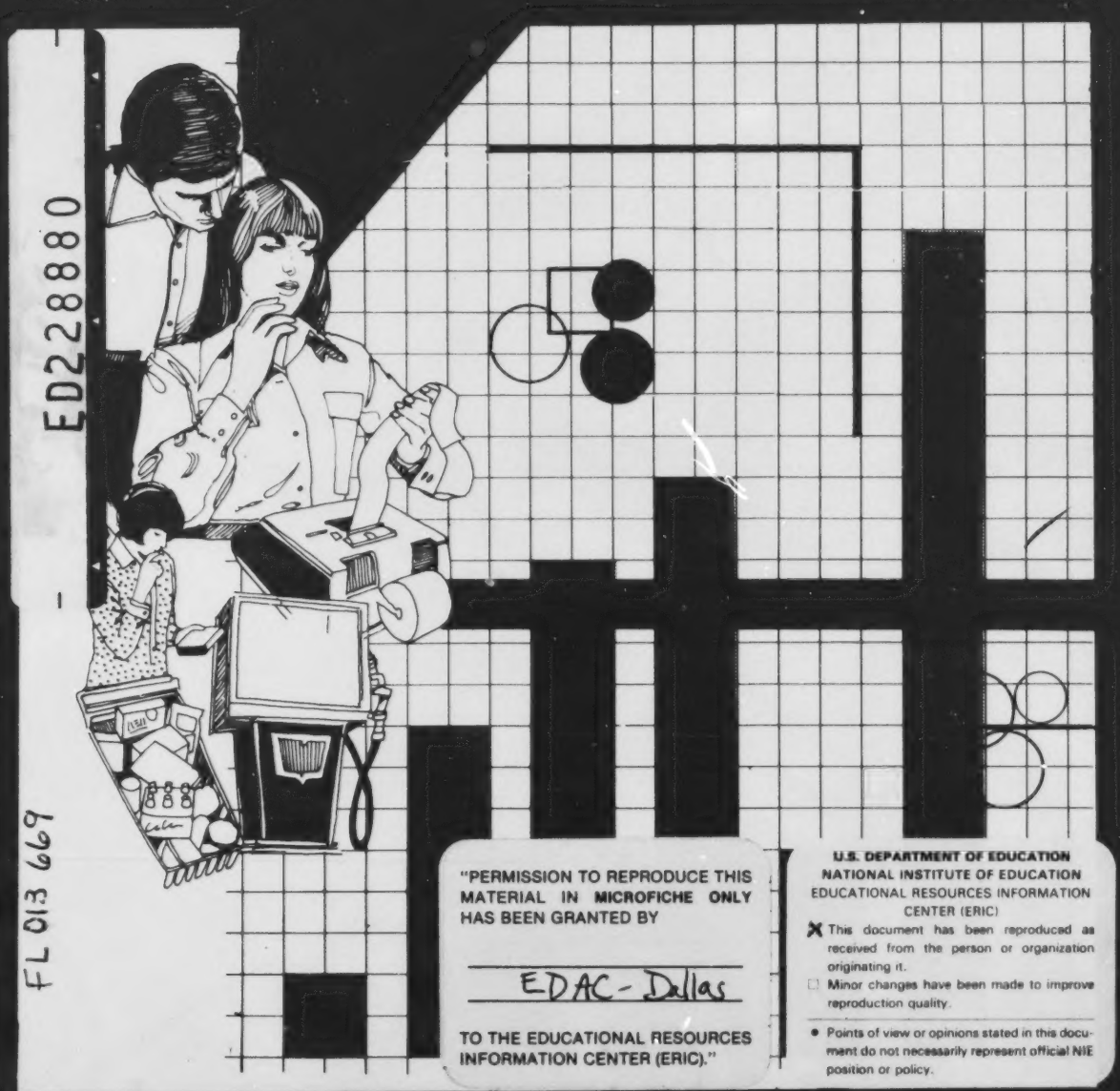
APPLIED BASIC CURRICULUM SERIES

Mathematics:

a practical view

Teacher Edition

Volume II



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INSTRUCTIONAL APPROACH

The activities in Mathematics: A Practical View are intended for the intermediate grades. Each of the three volumes of the series has three components which can be structured in different combinations. In this way, the teacher may choose and use those which best meet students' individual needs. Built around a review of selected objectives in the mathematics basic curriculum, the material stimulates interest in math as well as in the professional world. The first section of the component is designed to motivate students with challenging and fun problems. The second is closely related to objectives dealing with practical aspects of math in everyday life. The third component affords students valuable experience in solving math problems similar to those encountered in the real world. The order in which the three components are presented does not indicate sequence or level of difficulty. The activities contain narratives, puzzles, games, and fun activities which are of high interest and low readability. A detailed procedure section and a Home and Community activity are included in each section. Each activity includes exercises and evaluations based on the math skill reviewed. It is hoped that teachers will find these supplementary materials interesting, innovative, and motivational.

Component 1

Section One

Section Two

Section Three

ON THE ROAD TO A GOOD JOB

Introduction

This component is designed to show the importance of math in the field of transportation. The first section provides students with the motivation to do math well by introducing a game. By reading the narrative and by playing the game, students will realize the importance of transportation in modern society, and they will practice graphing ordered pairs in the cartesian coordinate plane. The second section stresses two life skills. The sudents will learn about working benefits, and they will practice reading maps. In the third section, the students will be given the opportunity to practice the math skill of solving stated problems, using the four basic operations with rational numbers. Each problem also gives some information about a transportation worker.

GOALS

MOTIVATION: The students will graph ordered pairs in the cartesian coordinate plane.

LIFE SKILLS: The students will learn about working benefits, such as retirement plans and insurance, and they will practice reading maps.

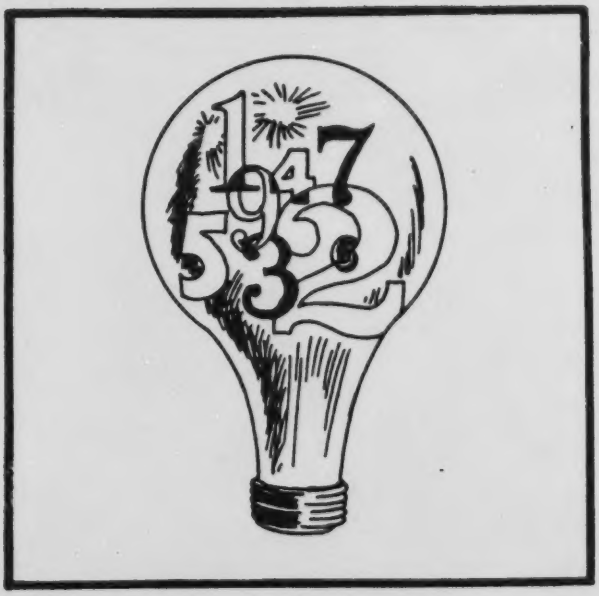
MATH SKILLS: The students will solve stated problems involving rational numbers by using the four basic operations.

LEARNING SECTIONS

SECTION 1: The Importance of Transportation

SECTION 2: On the Road to a Good Job

SECTION 3: Going Places with Numbers



COMPONENT I

Section One

Section One
The Importance of Transportation

Key Words

- transportation
- cartesian coordinate plane
- quadrant
- coordinate
- horizontal axis
- vertical axis

Learning Objective

Given a game featuring different modes of transportation, the students will graph ordered pairs in the cartesian coordinate plane, completing the activity according to the criteria of the teacher.

Materials

- one copy of the narrative for each student.
- one pencil for each student.
- overhead projector, if available, or chalk and chalkboard.

Domains and Levels

Cognitive: Knowledge, Application

Affective: Receiving, Responding

IMPLEMENTATION GUIDELINES

Time: *45 minutes*

Group Activity

STEP I - State the purpose of the activity:
To discover the importance of transportation in our daily lives, and to have fun with a game which will provide practice in graphing ordered pairs in the cartesian coordinate plane.

STEP II - Read and discuss "An Introductory Look at Transportation."

STEP III - Review the key words, if necessary.

STEP IV - Read and discuss the directions for "Transportation Takeover." This game is patterned after the familiar game of "Battleship," which students may have played. The teacher may want to demonstrate how to play the game on the chalkboard, or with the use of an overhead projector. If necessary, students should review how to graph ordered pairs.

STEP V - The students will divide into groups of two to play the game. The teacher should be free to answer individual questions.

Evaluation

STEP VI - The evaluation is to be completed by students working individually.

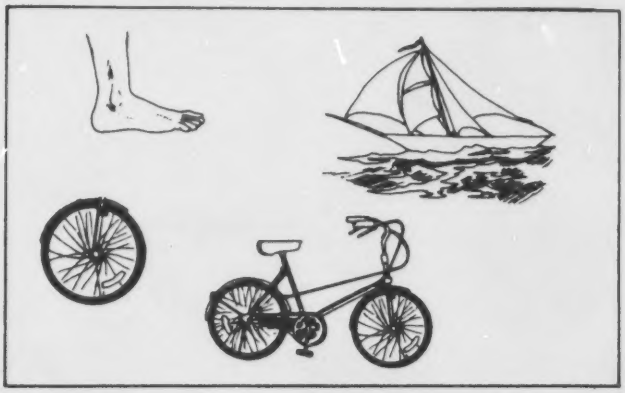
STEP VII - The Home and Community activity is optional, to be completed if time permits.

STUDENT ACTIVITY MATERIAL

THE IMPORTANCE OF TRANSPORTATION

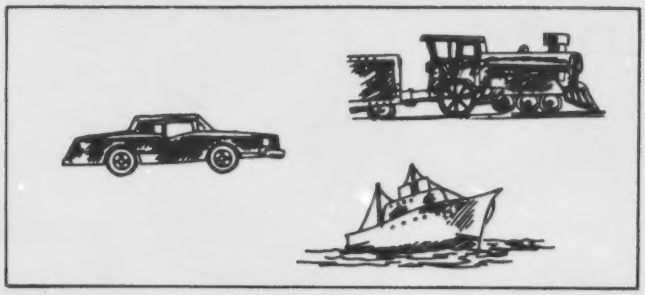
An Introductory Look at Transportation

Transportation is an essential part of our everyday lives. By various means of transportation, people and objects are carried from one place to another. Even though transportation affects just about every part of our lives, we usually don't give it much thought. That is, we don't think much about transportation until we can't find any! Just what is the history of transportation? And, what would we do without transportation?

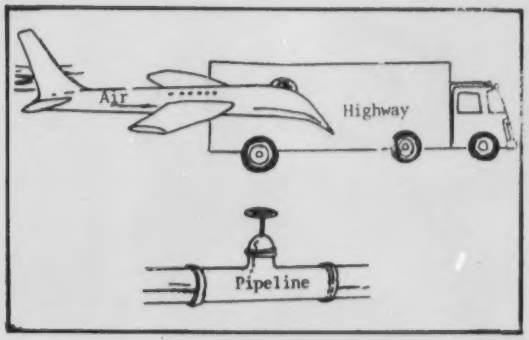


Foot power surely provided humans with their first method of transportation. Then, sometime in the very distant past, people began to use the backs of animals to transport themselves and other objects. Water was also used at an early stage, as people learned to float and sail down rivers and streams. And, of course, the discovery of the wheel had a great influence on many later types of transportation.

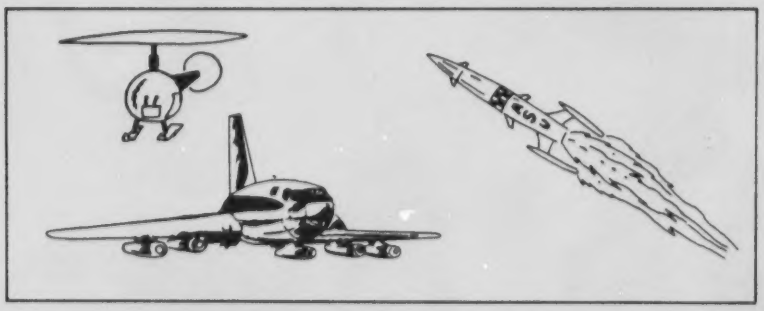
Today we think of transportation in terms of things that go on land, on water and in the air. The most familiar types of transportation are cars, buses, trains, boats, ships, airplanes



and helicopters. Perhaps you will be surprised to know that pipelines also provide a major source of transportation as they carry water, gas, and oil around our country.



What will the transportation of the future be? Perhaps we will transport people and goods between planets with some type of space travel. Here on earth, we may travel by air-cushion car, by tube, by automated highway, or by hydrofoil. People will probably always be looking for better, safer, and cheaper methods of transportation. What happens when one kind of transportation fails?



When this happens, many other things in our lives are changed. For example, when the bus drivers in a large city go on strike, many other businesses must close because people can't get to work. When a large storm interrupts the train schedule, goods are not delivered on time. This, in turn, may mean that factories and stores cannot do business as usual. And when a major airport is snowed in, hundreds of people find their lives changed as they sit and wait for hours. So you can see how important transportation is to our way of life. There are many jobs, and there probably always will be many jobs, for people who are interested in the field of transportation.

Transportation Takeover

"Transportation Takeover" is a game which will help you realize how important transportation is to all of us. In this game, the player who loses his or her means of transportation also loses the game! "Transportation Takeover" is also designed to give you practice in the mathematical skill of graphing ordered pairs of integers on a number plane.

This is how you play:

1. The game is played with two people.
2. Each player will need a game sheet and a pencil.
3. On the game sheet, each player will locate his or her means of transportation. Each player will have one car, one airplane, one boat, and one train. There can be only <u>one</u> means of transportation in each of the four quadrants.

4. Mark the location of your transportation in this way:

   Select one point for your car and put a C next to it.

   Select two points for your airplane and put an A next to these.

   Select three points for your boat and put a B next to these.

   Select four points for your train and put a T next to these.

   The points for each means of transportation must be one integer apart, and going either horizontally or vertically. (Thus, the car occupies one point while the train occupies four points.) Look at the sample in the following page.

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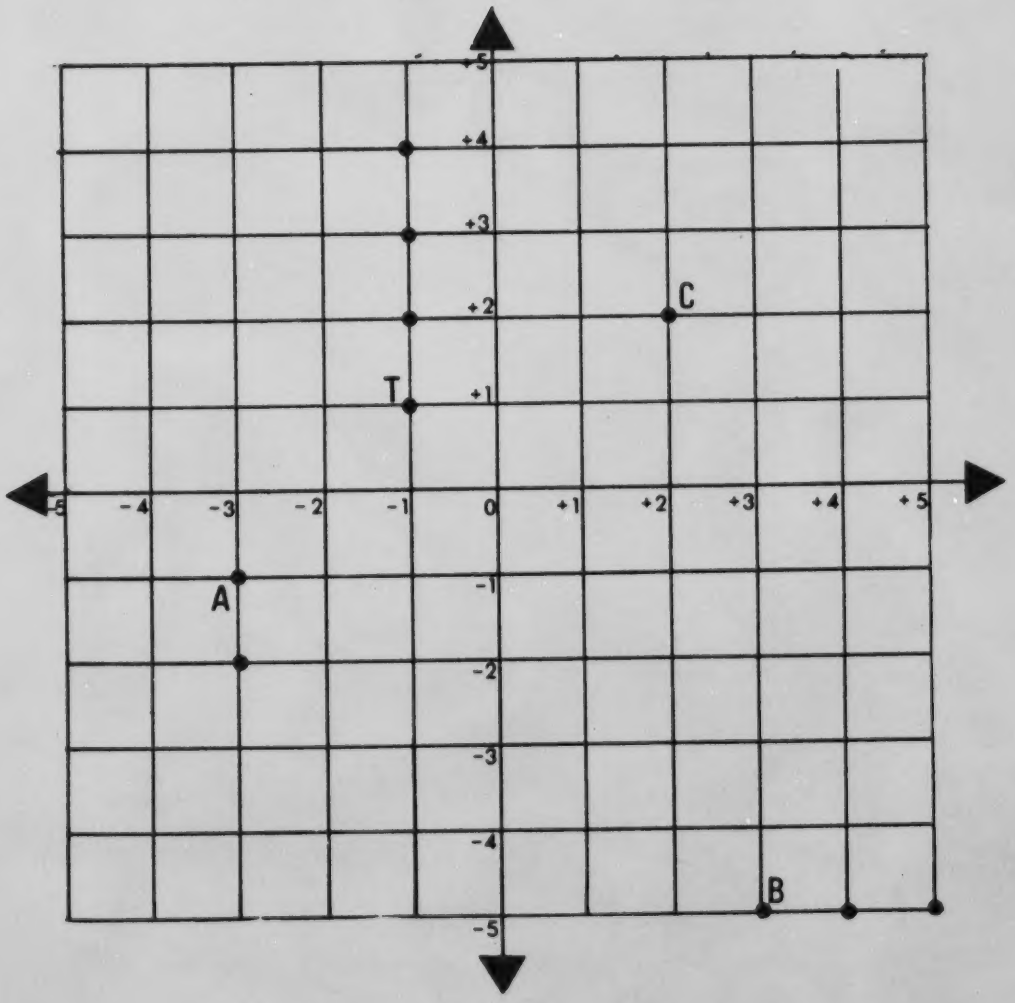
SAMPLE



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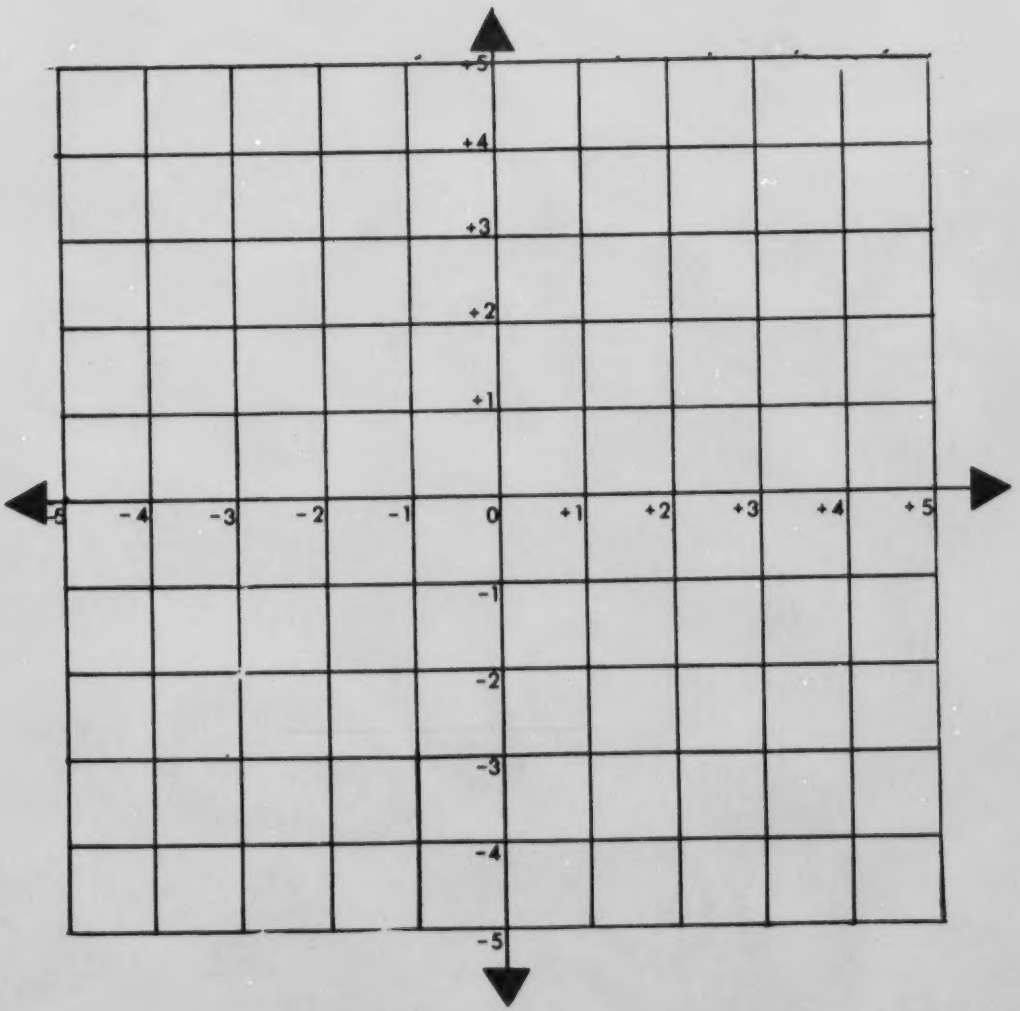
5. The object of the game is to guess the location of your opponent's transportation. The first player will call out an ordered pair of integers. If the second player has no transportation there, he or she will reply "miss." If the first player has correctly guessed the location of some transportation, the second player must indicate this by saying, "You found my car (or boat, etc.)."
6. Each player should keep a record of his or her guesses by putting a circle around incorrect guesses, and an a, b, c, or t on the location of correct guesses. (Capital letters show your transportation; lower case letters show your opponent's transportation.)
7. Each player receives only one guess for each turn.
8. The first player to eliminate all of the opponent's means of transportation will be the winner. All the points for a means of transportation must be located before that transportation is eliminated. (Four points for the train, for example.)

Game Sheet



C =

A =

B =

T =

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HOME and COMMUNITY

Students will keep a transportation record for one week. They will record the number of times they use any means of transportation and what type of transportation it is. In addition, students may wish to keep a record of all the goods which they receive in a week's time and what type of transportation is needed in the delivery of these goods. Students should share their records with one another at the end of the week.

Day	Time	Where I Went	Means of Transportation

EVALUATION

1. What kind of transportation do you depend on the most?

_____

2. What would your life be like if foot power suddenly became your only means of transportation?

_____

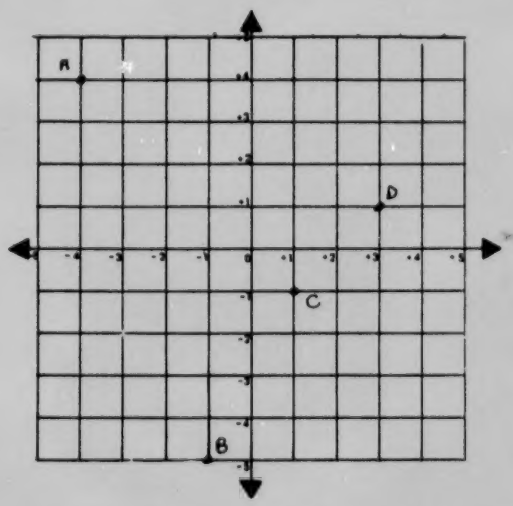
3. Use this number plane to name the ordered pair that corresponds to each letter.

A.

B.

C.

D.



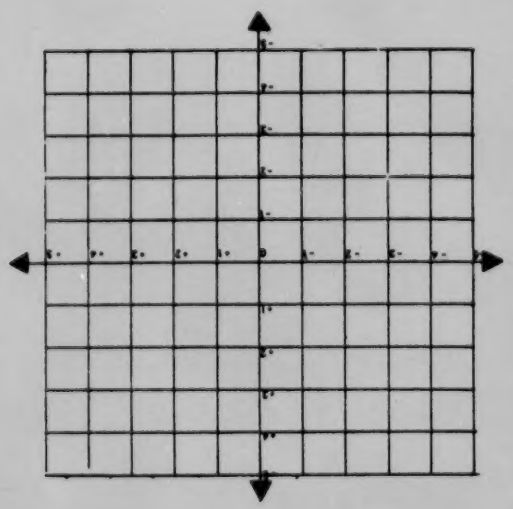
4. Locate each of the following ordered pairs on the number plane.

E. (+5,-3)

F. (-2,-4)

G. (+3,+1)

H. (-4,+4)



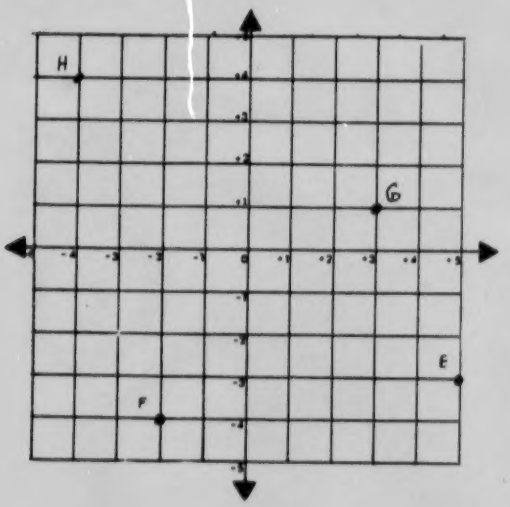
EVALUATION

ANSWER KEY

1. Any reasonable answer should be accepted.
2. Any reasonable answer should be accepted.
3. A. (-4,+4)

   B. (-1,-5)

   C. (+1,-1)

   D. (+3,+1)
4. 

COMPONENT I
Section Two

Section Two
On the Road to a Good Job

Learning Objective

Given a description of the jobs of bus and taxi driver, including a discussion of some of the working benefits of these jobs, the students will realize the importance of good map reading skills, and they will practice these skills. The activity will be completed according to the criteria of the teacher.

Key Words

- benefits
- employer
- insurance
- retirement plan
- salary
- self-employed

Domains and Levels

Cognitive: Knowledge, Application

Affective: Receiving, Responding

Materials

- one copy of the narrative for each student.
- one copy of a local street map for each student, if available.
- one copy for each student of a road map of the state in which the students live, if available.

IMPLEMENTATION GUIDELINES

Time: *45 Minutes*

This component stresses two life skills which will be useful to students. First, the students will learn that various jobs offer different types of working benefits. Secondly, the students will practice map reading, which is a life skill needed by everyone, whether they have a job in the field of transportation or in some other field.

Group Activity

STEP I - State the purposes of the activity: To learn about working benefits and to practice map reading skills.

STEP II - Read and discuss the section of the narrative called "Working Benefits." This can be done by reading aloud and pausing to answer or discuss the questions and concepts presented. Students should understand the meaning of the Key Words as they read this section.

STEP III - Read and discuss the sections entitled "The Bus Driver" and "The Taxi Driver." The teacher should stress the idea that these are just examples of two individuals. Benefits will vary from one employer to another.

STEP IV - About half of the class period should be reserved for the section on "Map Reading."

a. The teacher may wish to use the maps and questions provided in the narrative. Students can work individually or in groups.

or

b. The teacher may provide local street and road maps. In this case, the teacher must prepare in advance a list of streets and cities to be located, as well as distances to find. The students may find working with maps of their own city or state more meaningful than working with the sample maps.

Evaluation

STEP V - The evaluation covers only the material about working benefits. It should be done individually. The teacher may evaluate individual map skills while the students work on the map section. The teacher should make note of students who need extra practice.

STEP VI - The Home and Community section is optional, to be completed if time permits.

STUDENT ACTIVITY MATERIAL

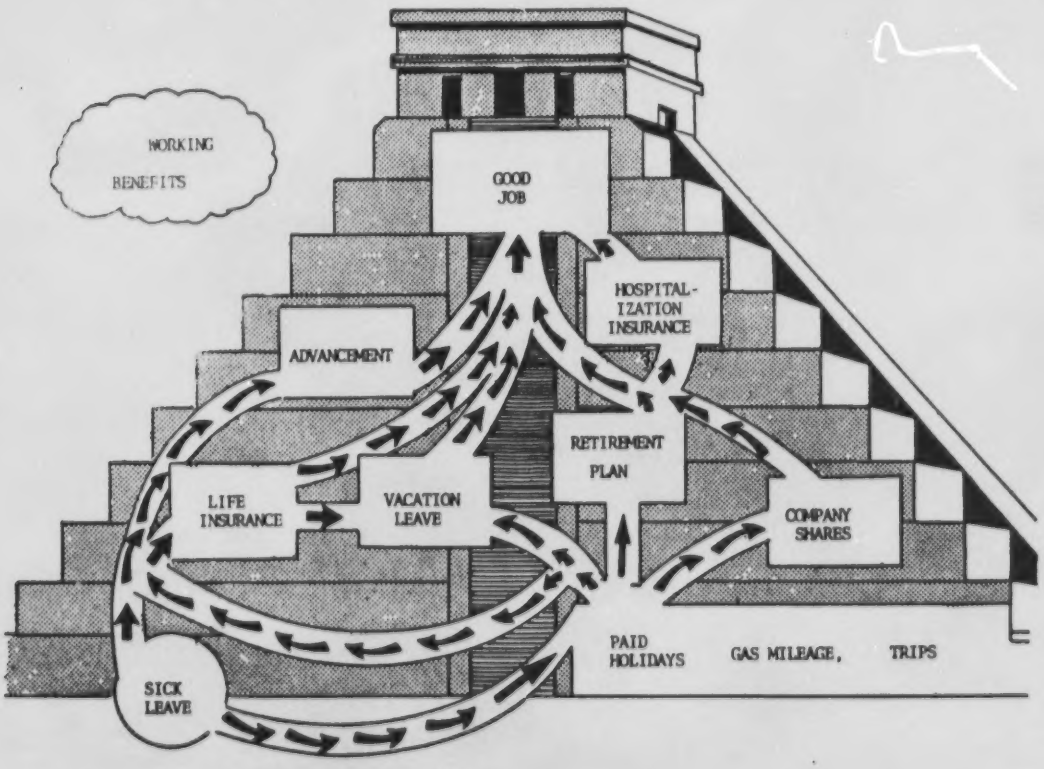
ON THE ROAD TO A GOOD JOB

Working Benefits:

What makes a job a good job? Probably the first thing many people think of is a good salary. Is a job good because the worker is paid a lot of money?

A second thing many people think of is whether or not the job is interesting to the worker. Is a job good if the worker makes lots of money, but dislikes the work or finds it very boring?

Different people will probably have different answers to these questions. However, all people who are looking for a job should also think about a third thing which can turn a job into a good job -- the working benefits. What are working benefits? These are extra payments, or working conditions, which are given to the worker in addition to a salary.



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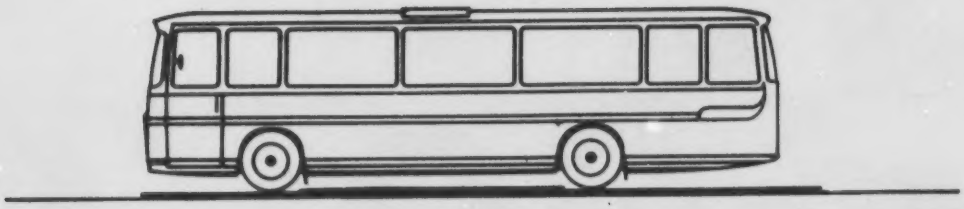
One of the most common benefits of a job is insurance. Many employers help their workers buy hospitalization and life insurance at a reasonable rate. Another common benefit is a retirement plan. The employer and the worker both put money into a retirement plan. Then, when the worker retires, he or she will continue to get a sum of money from the retirement fund. The money which the employer pays for a person's retirement or for insurance can make a good salary even better.

Another working benefit which an employer may give is vacation time and sick leave. These are considered benefits if the employer continues to pay the worker while he or she is on vacation or is sick. Of course, the employer decides how many paid vacation or sick days the worker will get.

When choosing a job, a person should consider both the salary and the benefits. A high-paying job with no benefits may not be better than a lower paying job with good benefits.

Let's take a look at two workers in the field of transportation -- the bus driver and the taxi driver. A description of their jobs will help you understand working benefits. (Keep in mind, though, that different employers may give different benefits. Not all bus and taxi drivers will get the same benefits as the two described here.)



The Bus Driver

Ray is a bus driver with the Quick-Trip Bus Company. He drives a bus between several large cities in two states. He usually drives about 400 miles round-trip.

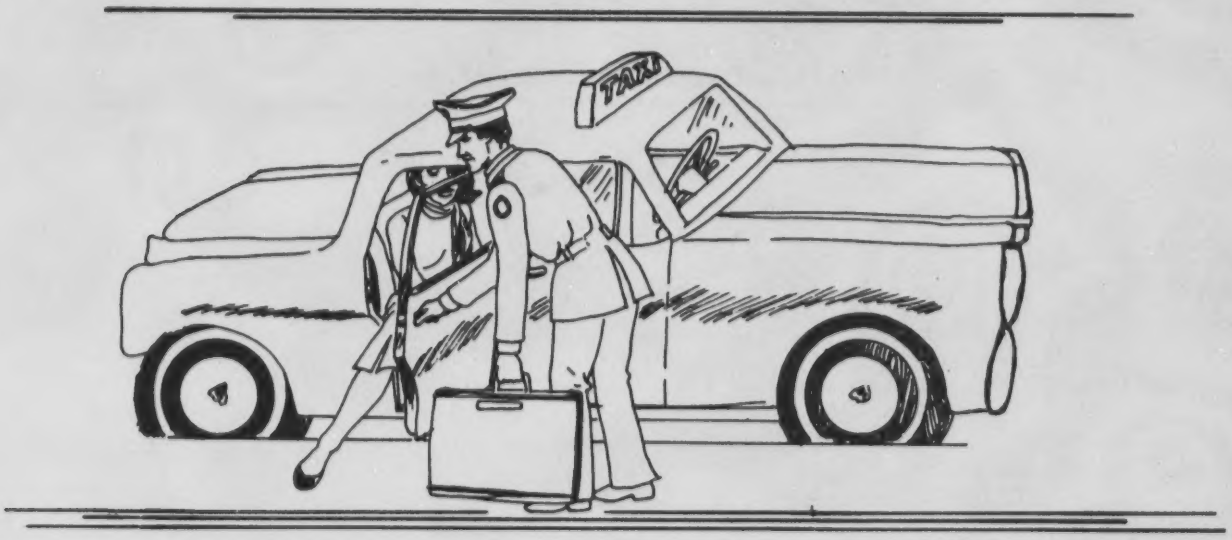
When Ray reports to the bus terminal, he first must check his bus. He is responsible for making sure that it is serviced properly. Ray also collects the tickets from the passengers as they board. In small stations, he loads luggage onto the bus, too. In large cities the baggage porters do this.

Ray likes his job with the Quick-Trip Bus Company for many reasons. He earns over $20,000 a year. He enjoys driving and meeting people. He also likes the working benefits which he receives from the Quick-Trip Company.

Every month, Ray puts 2½% of his salary into a retirement fund. The company puts this amount into Ray's retirement fund, too. The company also helps Ray buy insurance for himself and his family. Ray's medical insurance costs $130.00 a month. Ray pays $55.00 and his company pays $75.00 of this amount. If Ray wants life insurance, he can also share the cost of it with the company.

Sometimes Ray drives his bus on longer trips. When he has to spend the

night away from home, his company provides a place to stay. This, too is a benefit of Ray's job.



The Taxi Driver

Charlie is a taxi driver with the Get-U-There Cab Company. He owns his own taxi cab and is self-employed. Because a cab driver needs more than a car to be a success, Charlie pays a fee to the Get-U-There Company for some of the services he needs.

For example, the Get-U-There Company provides a dispatch service for all of the Get-U-There drivers. The dispatcher radios to the cab drivers when someone needs a ride. The company also provides clerks to do the paper work and liability insurance for the taxi cabs.

Each of the drivers must buy the same model car in order to be part of the Get-U-There Company. All of the cabs are painted the same, and they have the Get-U-There sign on them even though each driver owns his cab.

This and the other services help the drivers get customers. Of course, each driver wants to drive as many customers as possible. How much money a cab driver earns depends on how many customers he has and how far they go.

Because Charlie is self-employed, he does not receive working benefits from the Get-U-There Company. He must put aside money in a retirement fund for himself. If he wants insurance, he must buy it himself. Still, he likes his job. Charlie likes his driving and meeting people. He could have chosen to work for a taxi company which would give him more benefits, but Charlie decided he would rather be self-employed.

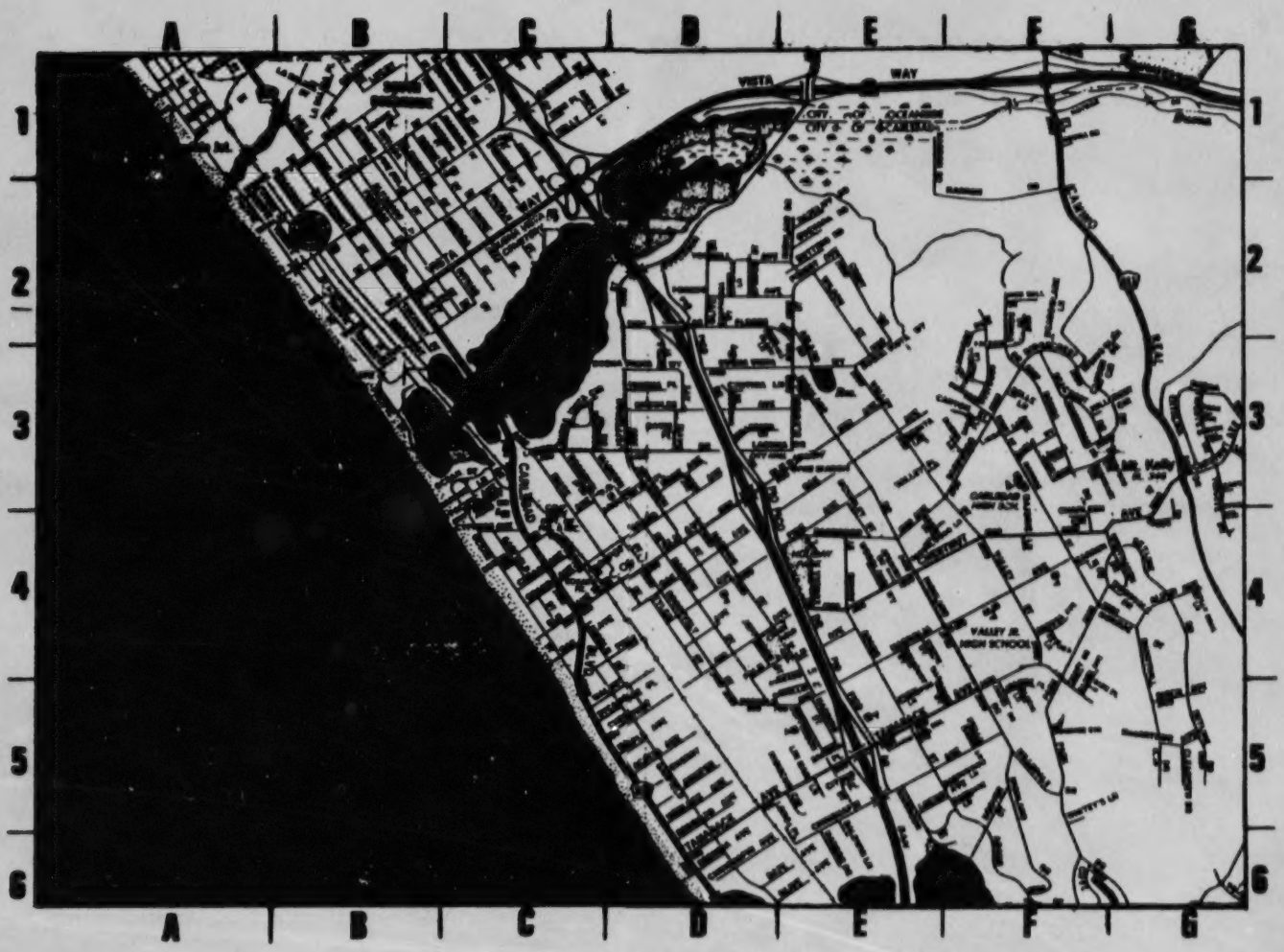
Map Reading

Now that you understand what working benefits are, it is time to think a little bit about the math skills which are needed by the taxi driver and

the bus driver. One of the most obvious things needed is the ability to read maps. Of course, the ability to read maps is needed by people who are not bus or taxi drivers, too. Today, you will practice some map reading. Someday you may decide to have a job in the field of transportation.

Exercises

1.



1. This is a street map. The taxi driver might need to read a map like this in order to take a customer somewhere. Use the street guide and the grids to find the following streets:
   Clementine Street, Canyon Street, Charleen Circle, Catalina Drive, Cherry Avenue, Chinquapin Avenue. Put a line with your pencil under each street name on the map.

Street Guide

You might use the following street guide if you like, in order to easily locate the streets.

Camden Cr.	F-3	Cherry Ave.	D-5
Cameo Dr.	G-3	Chinquapin Ave.	D-6
Camino del Sol	E-5	Chuparosa Wy.	D-2
Canyon St.	F-3	Cipriano Ln.	D-2
Capeaire St.	E, F-5	Citrus Pl.	E-5
Carlsbad Blvd.	C-3, 4	Clearview Dr.	G-5
Catalina Dr.	G-3	Clementine St.	B-1, 2
Cedar Ave.	C-4	Crest Dr.	E-2
Charleen Cr.	F-4	Cynthia Ln.	D-3
Charteroak Dr.	F-3	Cypress Ave.	C-4

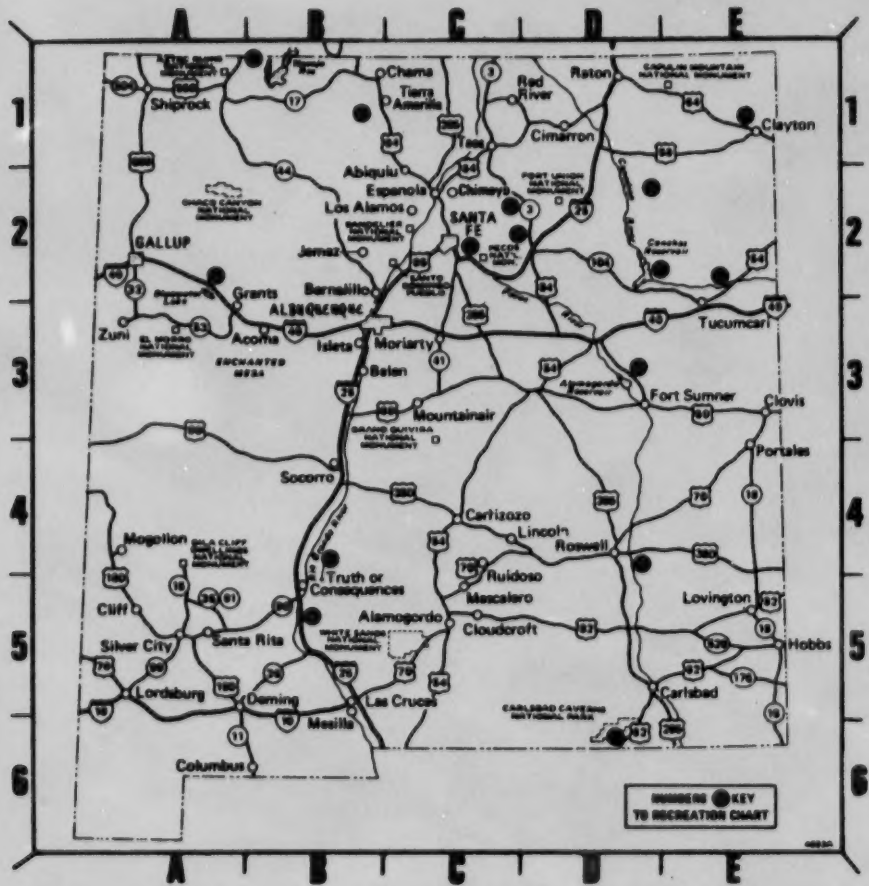
2. Many road maps look like this, although they are usually larger. The bus driver might need to use a road map to drive to a new location.

   a. Can you find these cities? Put a pencil line under each one on the map. Zuni, Raton, Columbus, Silver City, Lovington, Clayton.

   b. What highway would you take to travel from Santa Fe to Albuquerque? (Give the highway number.) _____

   c. What highway would you take to travel from Albuquerque to Gallup?

   _____



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** Map reproduced by permission of the American Automobile Association.

3. When reading a map, drivers also need to figure out distances. Can you use the map to figure out how far a driver would go between each of these cities?

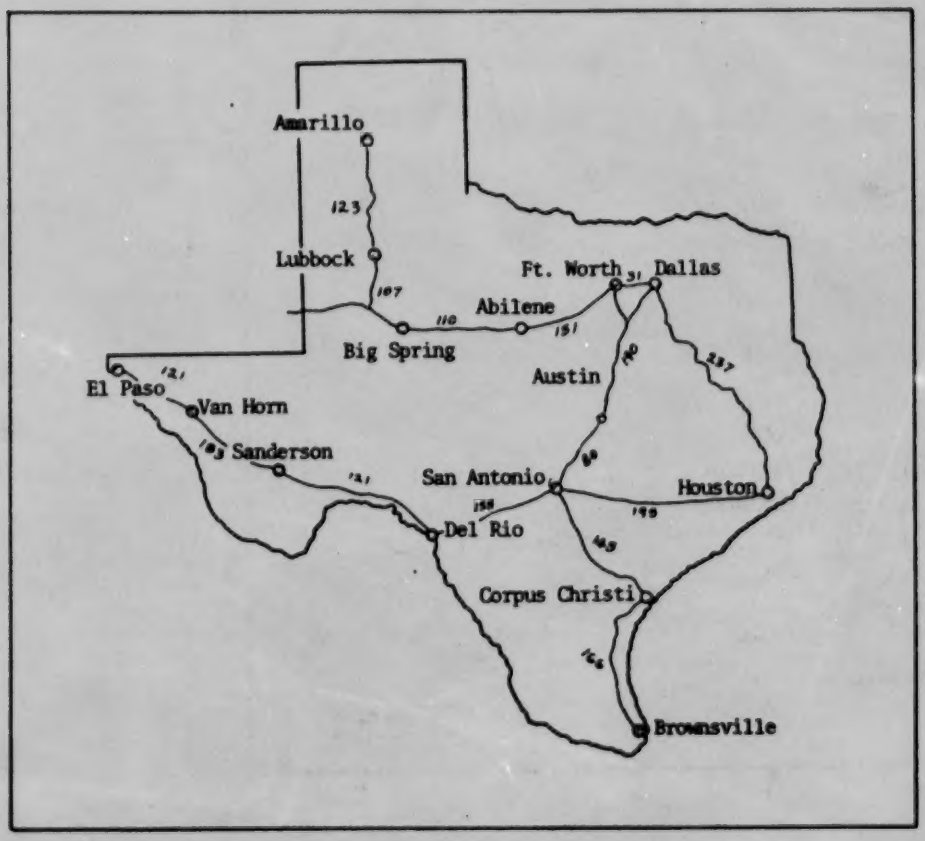
   a. Amarillo to Big Spring

   b. Ft. Worth to Dallas

   c. El Paso to Del Rio

   d. Brownsville to San Antonio

   e. Big Spring to Dallas



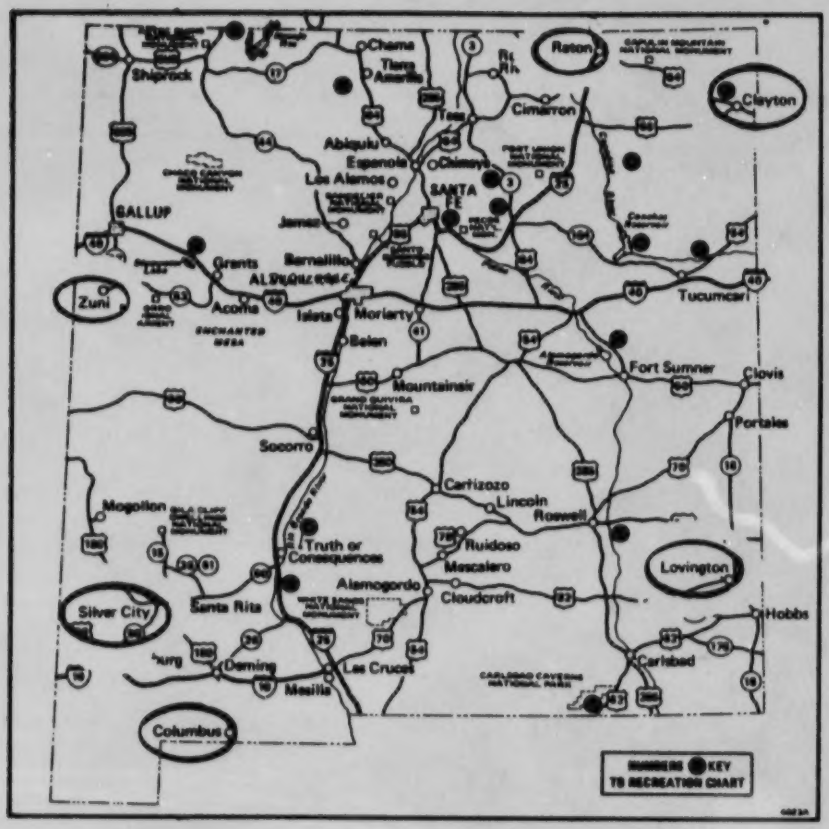
Key to Exercises

1.

Clementine	B-1, 2	Canyon	F-3
Cherry	D-5	Charleen	F-4
Chinquapin	D-6	Catalina	G-3

** Map reproduced with permission of the Automobile Club of Southern California

2.



a. Columbus	B-6	Raton	D-1	Silver City	A-5
Clayton	E-1	Lovington	E-5	Zuni	A-3
b. Highway 85		c. Highway 40			

3. a. 230 mi.
   b. 31 mi.
   c. 425 mi.
   d. 311 mi.
   e. 292 mi.

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HOME and COMMUNITY

The students may discuss any of the following questions with family members.

1. Does your employer contribute to your retirement fund?
2. Do you buy insurance with the help of your employer?
3. How much vacation and sick leave do you get each year? Are you paid for these days?
4. What do you think are the best benefits of your job?

EVALUATION

1. What are working benefits?

_____

_____

_____

2. Name three benefits which a job might offer.

_____

_____

3. Would you choose a high paying job with no benefits or a lower paying job with many benefits? Why?

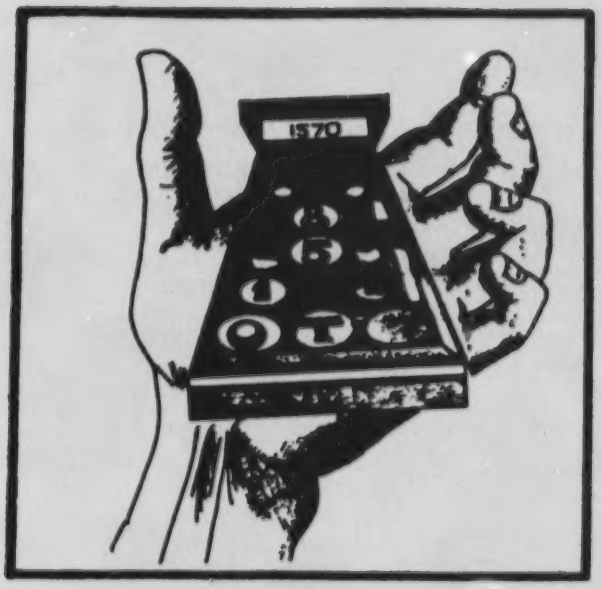
_____

_____

_____

ANSWER KEY

1. extra payments, or working conditions, which are given in addition to salary.
2. retirement plan, insurance plan, vacation and sick days
3. any reasonable answer should be accepted.



COMPONENT I

Section Three

Section Three
Going Places With Numbers

Key Words

. transportation

Learning Objective

Given an account of various workers in the Transportation Cluster, the students will solve stated problems involving rational numbers by using the four basic operations, with 75% accuracy.

Materials

. one copy of the narrative for each student

Domains and Levels

Cognitive : Knowledge, Application

Affective : Receiving, Responding

IMPLEMENTATION GUIDELINES

Time: 45 Minutes

STEP I - State the purpose of the activity:
to learn about various jobs in the Transportation Cluster and to solve stated problems involving rational numbers.

STEP II - Read and discuss the introductory section of the narrative, "Going Places with Numbers."

STEP III - Students will solve the problems by working individually. The teacher will be free to answer questions and to help individual students with problems. (Problem # 8 may be more difficult than the others. The teacher may wish to assign it only to the more advanced students).

Evaluation

STEP IV - The evaluation is to be done by students working individually.

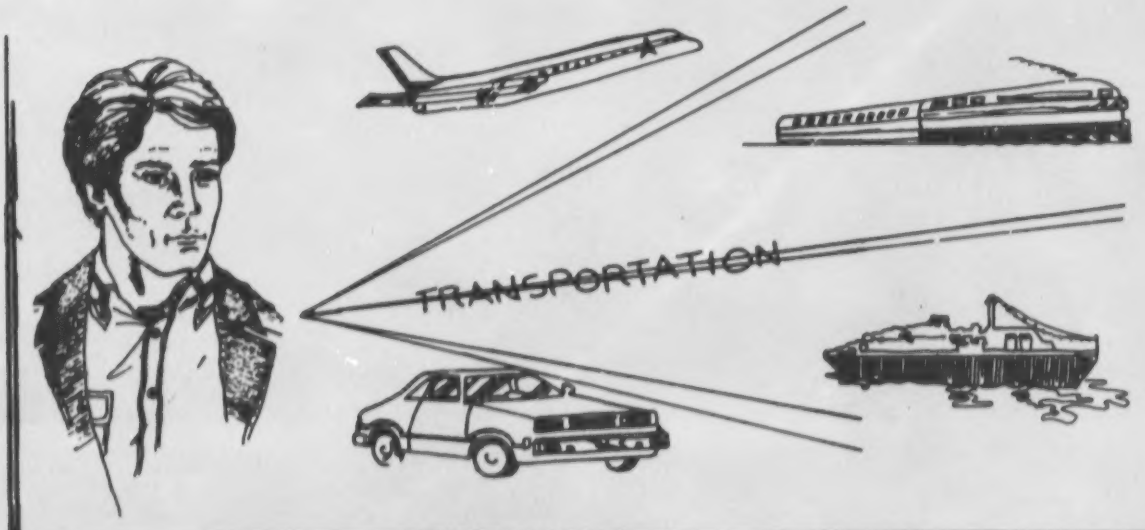
STEP V - The Home and Community section is optional, to be completed if time permits.

STUDENT ACTIVITY MATERIAL

Going Places with Numbers

Have you ever thought about having a job in the field of transportation? When we think about transportation jobs, most of us think first about being drivers. It is true that we could not have transportation without bus drivers, airplanes pilots, train engineers, and other drivers. But, there are also hundreds of other kinds of transportation jobs which do not involve driving. For example, we would have not bus transportation without bus drivers. But people are also needed to repair the buses, to sell tickets, to supervise the bus terminal, to put fuel in the buses, to take care of luggage, and to do other jobs.

The following problems will give you just a sample of the many types of jobs available in the field of transportation. In each problem you will see that the worker might need to solve a math problem correctly in order to do the job well.



PROBLEMS

1. Sam is a parking lot attendant. He works for eight hours a day. He parks cars for customers, and he drives cars to the exit when a customer is ready to leave. Sam also figures up how much each customer owes. One day when Sam came on duty, there was $178.75 in the cash register. When he left that day, there was $412.25 in the register.

   Q: How much money did Sam take in that day?

2. Betty is a gas station attendant. She pumps gas for customers. She also cleans windshields, changes oil, and helps make repairs. Betty has just filled up a tank with gasoline. The gasoline costs $1.36 a gallon. The customer owes Betty $14.96.

   Q: How many gallons of gas did Betty put in the tank?

3. George is a bus driver. He drives an express bus between a large city and the airport.

   It costs the bus company $245.00 a day to operate the bus. One day George had fewer riders than usual. All day long only 26 people rode the bus. Each one paid $6.00 for the bus ticket.

   Q: Did the bus company earn or lose money that day? How much?

4. Norma is a station master. Her job is to manage the train station. She needs to know the schedule of each train. She often answers passengers' questions about the arrival and departure of trains.

   The Silver Express arrives every day at 8:10 a.m. One winter night, a snow storm slowed all the trains. Norma learned that the Silver Express would be 4 3/4 hours late.

   Q: At what time did the Silver Express arrive?

5. Harold is an airline reservation agent. He makes reservations and he schedules trips for passengers. He may make reservations for people over the telephone or when they come to the airport. Harold often helps his customers figure out the most economical way to fly.

   One passenger wanted to fly from Dallas to San Francisco and back. A one-way ticket would cost $220.00 and a round-trip ticket would cost $352.00

   Q: How much money would the passenger save by buying a round-trip ticket instead of two one-way tickets?

6. Annie is a long-distance truck driver. She drives a trailer truck which carries materials to and from factories. Sometimes Annie must decide which of several routes to take. There are two roads which Annie can take between Porterville and Overton. The first road goes through the mountains. The distance is 192 miles. Because of the mountains, Annie can average only 40 miles per hour. The second road between the two cities is 226 miles long. Annie can average 55 miles per hour on this road.

   Q: Which road will Annie choose to get her there most quickly?

7. Pedro is a truck driver for the Good Grain Bread Company. Each day he delivers bread from the factory to a number of grocery stores in the city. Besides driving the truck, Pedro loads and unloads the bread. He puts the bread on the shelves. Pedro drives the truck five days a week. He drives an average of 45 miles a day.

   Q: About how many miles does Pedro drive each week?

8. Olivia is a dispatcher for the O.K. Cab Company. She receives telephone calls from people who want a taxi to pick them up and take them somewhere. Olivia then radios to a cab driver and gives the driver the necessary information. One evening, at 6:15, Olivia received a call from a woman who wanted a cab to pick her up at 6:30. Olivia knew that Cab A was 10 miles away from the woman's home. Cab A can drive 50 miles per hour on the freeway to reach the woman's home. Cab B is only 4 miles away from the woman's home. But cab B must drive on crowded city streets and can only average 15 miles per hour.

   Q: Which cab will Olivia send if the cab must be there by 6:30?

   Why?

ANSWER KEY

1. $233.50
2. 11 gallons
3. The company lost $89.00
4. 12:55 p.m.
5. $88.00
6. the second road (226 mi.)
7. 225 miles
8. Cab A, because Cab B will get there after 6:30

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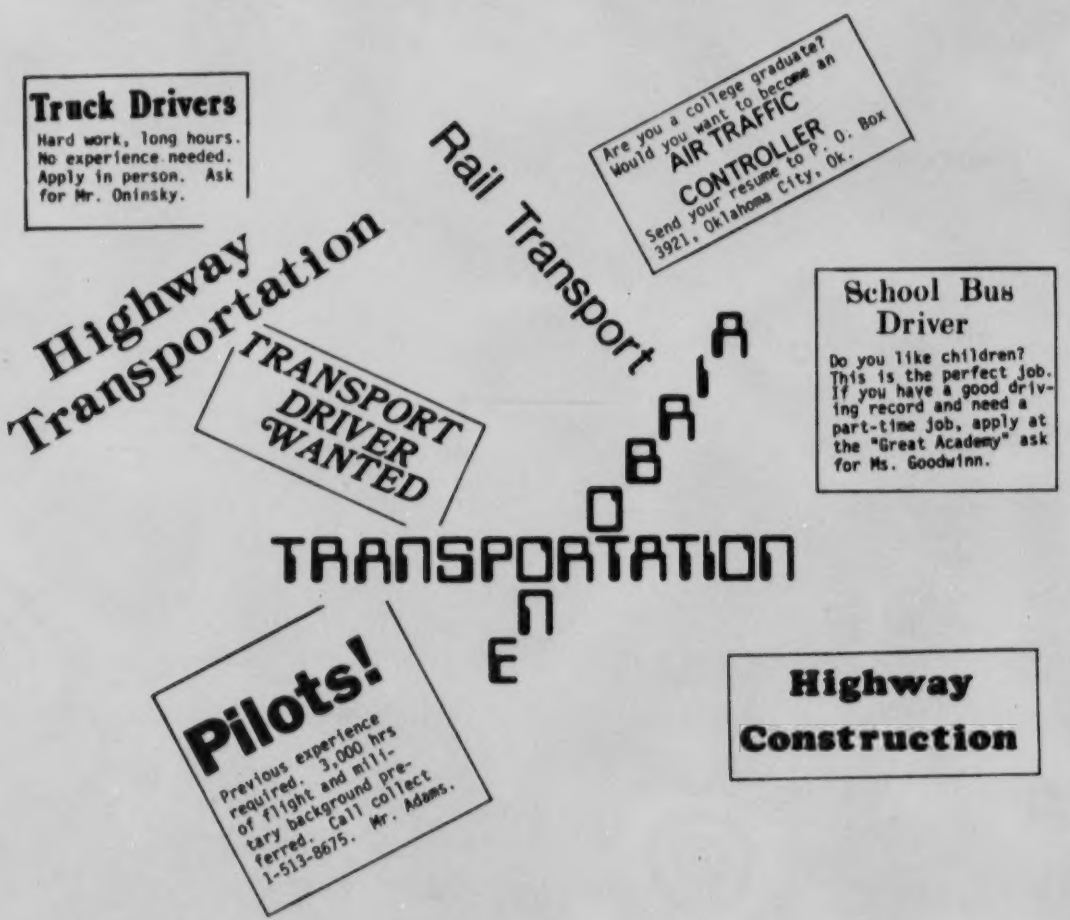
HOME and COMMUNITY

The students will search the "Help Wanted" advertisements in the classified section of the newspaper. (This can be done at home or in the library.) They will clip or copy down the pertinent information from advertisements for jobs in the field of transportation. The students should be prepared to discuss whether any mathematical skills would be needed for each of the jobs they have found.


Truck Drivers
Hard work, long hours. No experience needed. Apply in person. Ask for Mr. Oninsky.
Are you a college graduate? Would you want to become an AIR TRAFFIC CONTROLLER Send your resume to P. O. Box 3921, Oklahoma City, Ok.
Rail Transport
Highway Transportation
TRANSPORT DRIVER WANTED
School Bus Driver
Do you like children? This is the perfect job. If you have a good driving record and need a part-time job, apply at the "Great Academy" ask for Ms. Goodwinn.
TRANSPORTATION
Pilots!
Previous experience required. 3,000 hrs of flight and military background preferred. Call collect 1-513-8675. Mr. Adams.
Highway Construction

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EVALUATION

Evaluation

1. Name at leat three jobs in the field of transportation which do not involve driving.

_____

_____

_____

2. A taxi driver has driven a passenger from the airport to his home. The taxi has gone a distance of 16 3/4 miles. The fare is 20¢ for every quarter of mile driven.

   a. How much money does the passenger owe the driver ?

   b. If the passenger gives the driver a $20.00 bill, how much change should the driver give back?

   c. If the passenger wants to give the driver a 15% tip, how much should the tip be?

ANSWER KEY

1. ticket seller, reservation agent, station master, parking lot attendant, dispatcher, luggage carrier, gas station attendant, and others.
2. a. $13.40
   b. $ 6.60
   c. $ 2.01, or $2.00 if rounded to nearest dollar

Component 2

Section One

Section Two

Section Three

BUILDING FOR YOUR FUTURE

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Introduction

The purpose of this component is to show how workers in the Construction Cluster use mathematics, and in particular how they might need to figure out the area and perimeter of geometric figures. In the first section, the students will make paper models of cubes, cylinders, and rectangular and triangular solids to discover how an architect might begin to plan a building, and how he or she might consider various arrangements of geometric figures. In the second section, the students will learn how the carpenter gains specific types of knowledge during various stages of his or her training, and how this leads to the achievement of a career goal. Students will have an opportunity to practice the skill of figuring the area and perimeter of geometric figures in the third section. At the same time, they will learn that a variety of construction workers might need to use this same skill.

GOALS

MOTIVATION: The students will find the area and perimeter of imaginary buildings, using models of cubes, cylinders, and rectangular and triangular solids.

LIFE SKILLS: The students will learn that gaining specific knowledge, such as learning how to compute areas and perimeters, is a means of achieving a particular career goal.

MATH SKILLS: The students will determine the area and perimeter of geometric figures (triangles, square, rectangle, circle, trapezoid), and they will use these to solve related problems.

LEARNING SECTIONS

SECTION 1: Building Blocks

SECTION 2: An Interview with a Carpenter

SECTION 3: Building a Foundation in Math

COMPONENT II

Section One

Section One
Building Blocks

Key Words

- area
- perimeter
- construction
- architect

Learning Objective

Given models of cubes, cylinders, and rectangular and triangular solids, the students will discover that the architect must consider area and perimeter when planning a construction. The students will complete the activity according to the criteria of the teacher.

Materials

- one set of model patterns for each student.
- one pair of scissors and
- tape (or glue) for each student.
- one copy of the narrative and problems for each student.

Domains and Levels

Cognitive: Knowledge, Application, Synthesis

Affective: Receiving, Responding

IMPLEMENTATION GUIDELINES

Time: *45 Minutes*

STEP I — Introduce the activity by reading together and discussing the narrative, "Building Blocks."

STEP II — Re-state the purpose of the activity:
To discover how an architect might use models in planning a building, and to see that the ability to determine areas and perimeters is necessary for jobs in the Construction Cluster.

STEP III — Each student will cut out and assemble a paper cube, cylinder, and rectangular and triangular solids. These models can be taped or glued together.

Small Group Activity

STEP IV — Divide the class into small groups of four to six. Each group will tape four to six sheets of graph paper into a larger rectangle to use as a "planning board." (This paper is included with models.) By placing the models on this graph paper, the students will be able to figure out areas and perimeters.

STEP V — Each small group will work the problems together. One person in each group will be chosen to record the group's answers to the questions.

STEP VI — If time permits, small groups can share their answers with the entire class at the end of the class period. Each group will probably have discovered different solutions, especially to problems four and five.

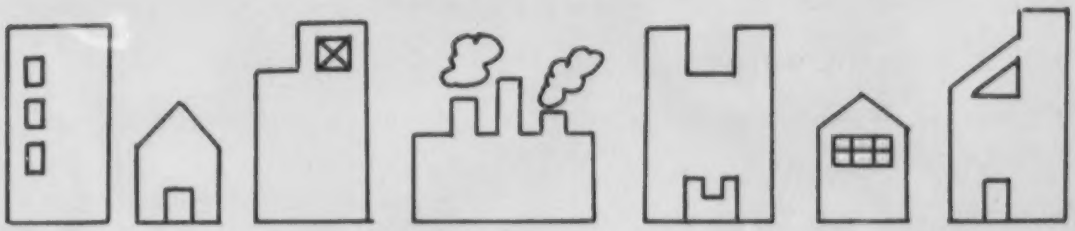
Evaluation

STEP VII — The evaluation is to be completed by students working individually.

STEP VIII — The Home and Community activity is optional, to be done time permitting.

STUDENT ACTIVITY MATERIAL

Building Blocks



When you were younger, you may have had a set of building blocks. Most kids like to build factories, castles, roads, houses, and barns with their blocks. It's fun to be the creator of a whole town, even if it's just make-believe.

As you grew older, of course, you became more interested in building real things. You may have put aside your imaginary towns made of wooden blocks and begun to try out real tools and materials. Many adults never lose their interest in building things. Some of these people choose jobs in construction.

The architect has a very important job in construction. The architect's job is one of planning. Architects design houses, churches, office buildings, schools, and hospitals. They may also plan airports, university campuses, and new towns.

In order to do a good job, the architect must have a good understanding of mathematics. It is also important for the architect to be able to plan the building so it is right for the climate, the available space, and the needs of the people who will use the building. Do you suppose that making a model is something like playing with blocks?

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Today you will have a chance to "play with blocks." You will use these "blocks" to see how an architect might plan different types of buildings. You will also use two mathematical skills — finding the surface area and the perimeter — to solve some building problems which an architect might have.

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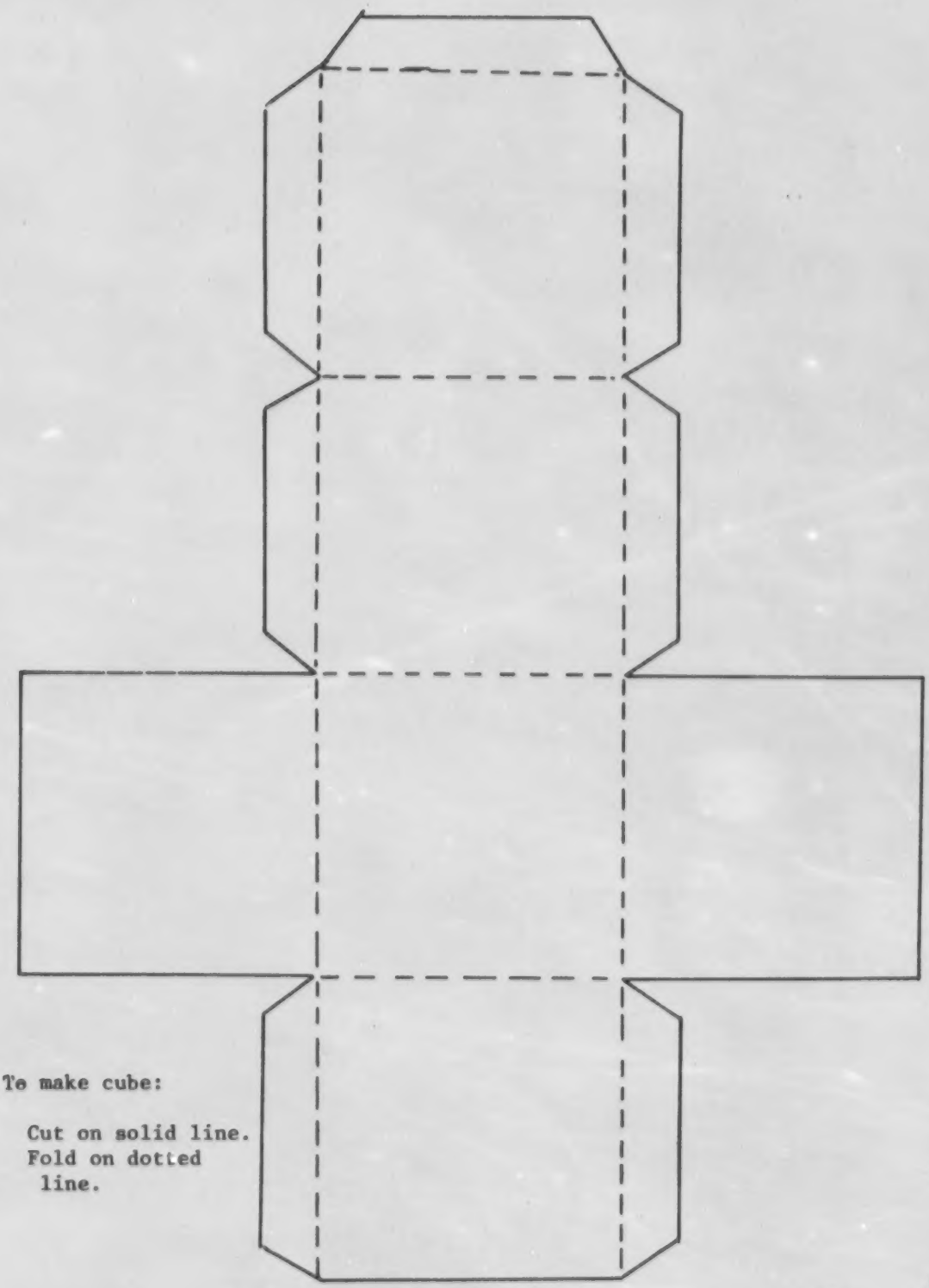

To make cube:

Cut on solid line.
Fold on dotted line.

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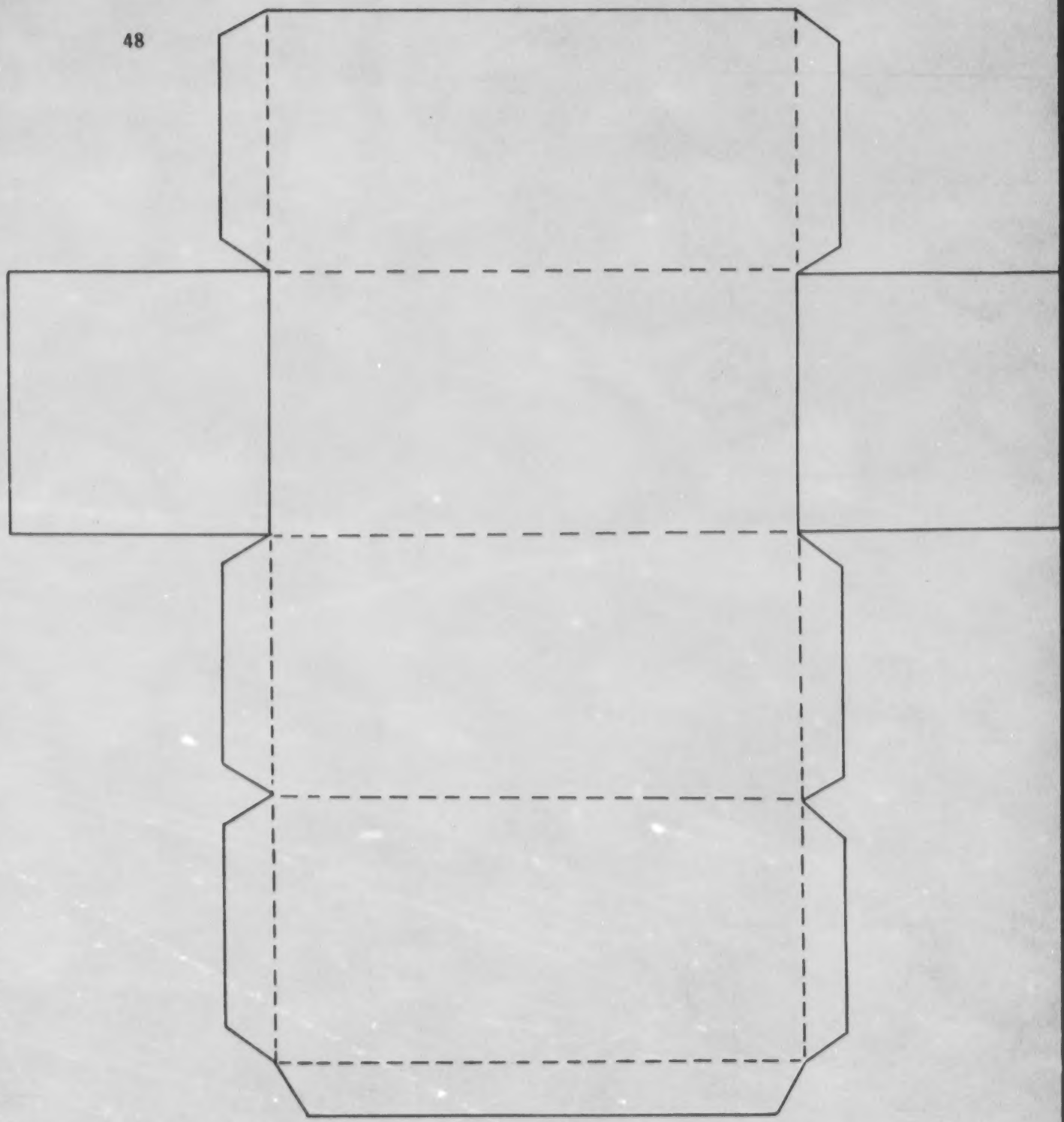
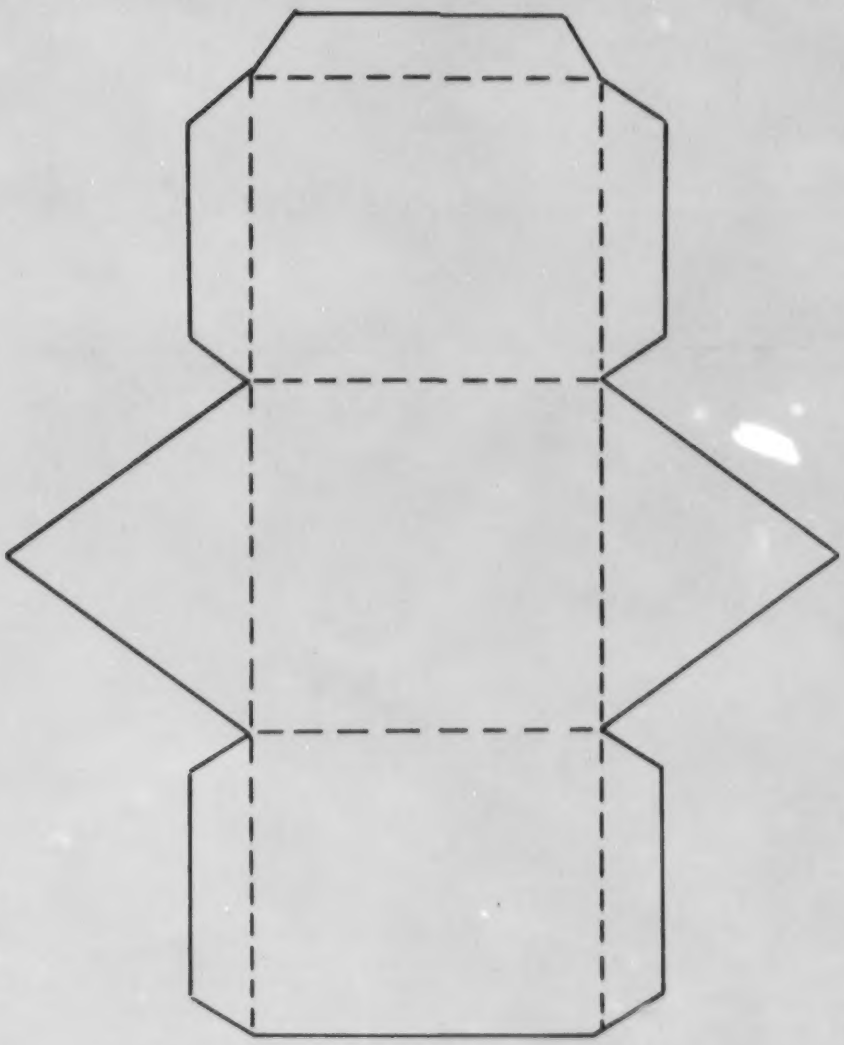


To make rectangular solid:

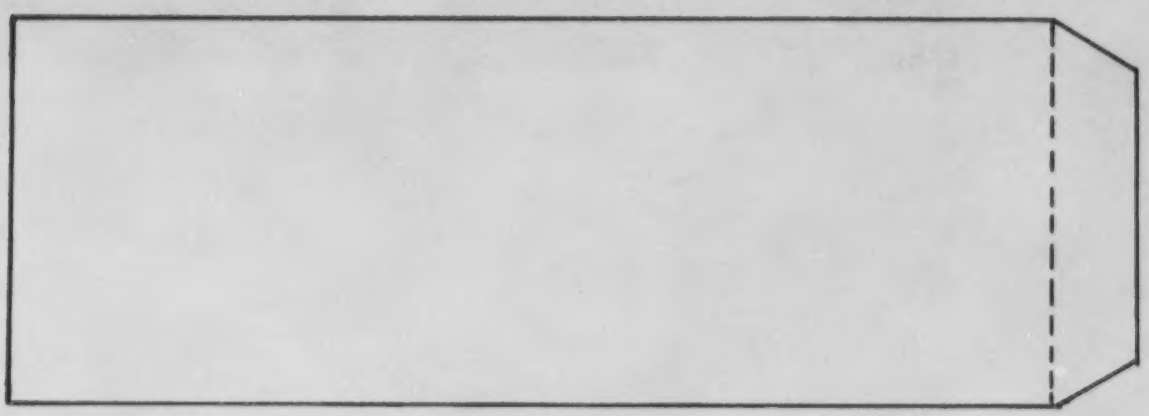
60 Cut on solid line.
Fold on dotted line.

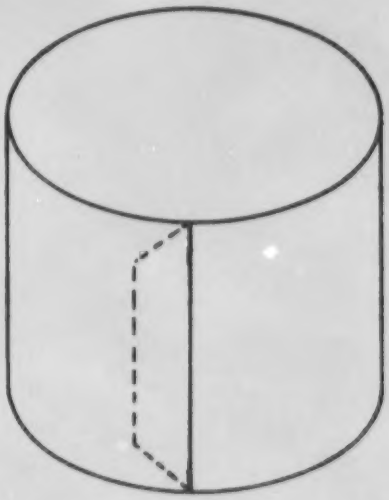


To make triangular solid:

Cut on solid line.
Fold on dotted line.

50





To make cylinder:

1. Cut out on solid line.
2. Roll to form cylinder.
3. Tape tab to inside of cylinder.

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Problems

Using graph paper, solve the following:

1. Can you use all the cubes your group has to make a building with the smallest possible perimeter?

   Question: How many units long is the perimeter? (Each square on your graph paper is one unit wide and one unit long.)

2. Now, use the same number of cubes to make a building with the largest possible perimeter.

   Question: How many units long is the perimeter of this building?

3. Build a house using two cubes. Use two triangular solids to make a roof.

   Question: Suppose that the roof will have shingles on it. The rest of the house will be painted. What is the area of the surface to be painted?

4. Use all of your models to make an attractive-looking modern building.

   Question: What might the building be used for?

Question: What is the perimeter of the ground floor?

_____

Question: What is the area of the ground floor?

_____

5. Can you re-arrange your blocks to make a completely different building?

_____

Question: How are the answers to the question in problem number 4 different for this new building?

_____

Question: Did you use cylinders to make rooms? How would the area of the round room be different from the area of a room made with a cube?

_____

_____

ANSWER KEY

Problems

The answers will vary according to the group. The teacher will want to check each group on at least one problem. The teacher may wish to point out to the rest of the class particularly original or interesting solutions to questions four and five.

HOME and COMMUNITY

The students will draw a sketch of three or four different buildings which are found in their community. They will then find and label the different geometric figures which they see in the buildings. The students will bring their sketches to class on a subsequent day and discuss which styles of building they think are most attractive.

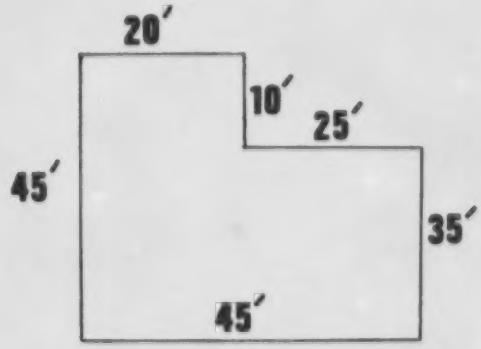
EVALUATION

Evaluation

1. Would you like to be an architect? Why or why not?

2. What are some skills the architect needs?

3. An architect has planned this new house.



a. What is the perimeter of the house?

b. What is the area of the house?

EVALUATION

Answer Key

1. Answers will vary.
2. The architect needs math skills, such as figuring area and perimeter. The architect needs to know how to plan.
   The architect may need to have some artistic skill.
   (Other reasonable answers will also be accepted.)
3. a. 180 feet
   b. 1375 square feet

COMPONENT II
Section Two

Section Two

56

An Interview with a Carpenter

Learning Objective

Given real life problems dealing with the perimeter and area of rectangles, the students will determine how specific knowledge is a means of achieving a particular career goal. The activity will be completed with 80% accuracy.

Key Words

- rectangle
- area
- perimeter
- carpenter
- apprentice
- journeyworker

Domains and Levels

Cognitive: Knowledge, Comprehension

Affective: Valuing

Materials

- copies of the narrative for each student.

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IMPLEMENTATION GUIDELINES

Time: *45 Minutes*

Note: It is important for students to realize that gaining specific knowledge will help them achieve particular career goals. Being able and willing to acquire such knowledge in pursuit of career goals is the life skill which is emphasized in this component.

STEP I - Stimulate discussion with questions such as these:

a. What job would you like to have when you grow up?

b. What training would you need for that job?

c. Would you need mathematical skills for that job?

STEP II - State the purpose of this activity:
To learn how the carpenter is trained and to see what math skills are needed for this job.

STEP III - The activity can be accomplished in several ways:

a. Students can read and answer the questions individually.

b. The teacher can guide the reading and discussion with the class as a whole.

c. If students answer the questions individually, the class may discuss the answers together toward the end of the class period.

d. The teacher should make sure that students understand the meaning of the words apprentice and journeyman (or journeyworker).

Evaluation

STEP IV - The evaluation is to be completed by students working individually.

STEP V - The Home and Community activity is optional and will be done time permitting.

STUDENT ACTIVITY MATERIAL

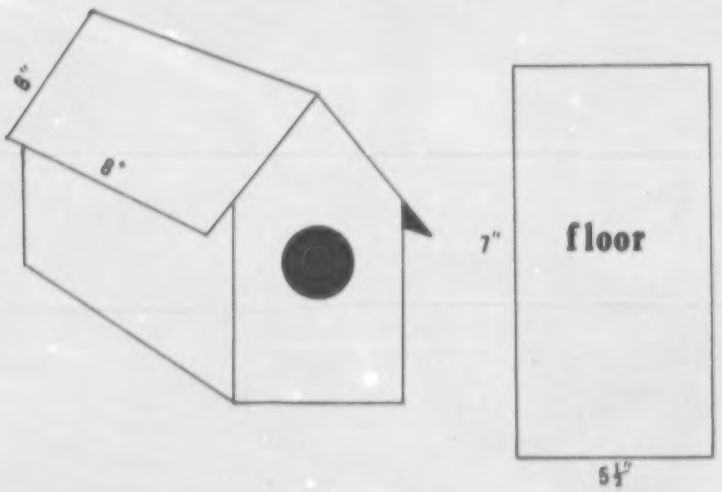
Introduction

Juanita and Eddie are in junior high school. Their social studies class is studying careers. Each student has to interview someone who has a job which the student finds interesting. Both Juanita and Eddie are interested in being carpenters. They have decided to talk with Mr. Yamamoto. He has been a carpenter for many years. Let's find out what Juanita and Eddie can learn from Mr. Yamamoto.

An Interview with a Carpenter

1. Eddie began by asking, "When did you first decide you might like to be a carpenter?"

   Mr. Yamamoto answered, "I began to be interested when I was a very little boy. My daddy gave me a tool box and helped me build things. He taught me how to use the tools. He also taught me how important it is to plan before you begin to saw and hammer. I still have the plans we made for the first thing I built -- a birdhouse. Here they are!"



Questions:

a. What did Mr. Yamamoto learn when he was a little boy which helped him become a carpenter?

b. What is the perimeter of the birdhouse floor?

c. What is the area of the birdhouse floor?

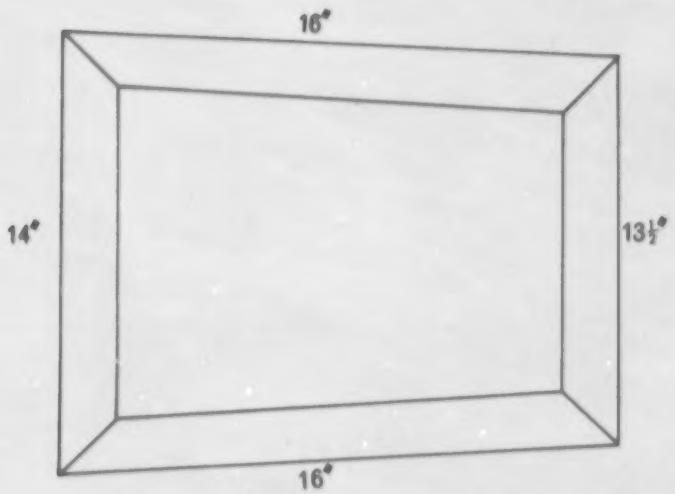
2. "But that wasn't enough training to make you a carpenter, was it? What did you do next?" asked Juanita.

"Well, when I was in high school I took shop and woodworking classes. I still hadn't decided to be a carpenter, but I knew I liked the classes. I also knew I would always be able to use my building skills, even if I decided to take a different job."

"What did you learn in these classes?" Eddie questioned.

"I learned how to use power tools. I also learned the importance of measuring carefully. I learned <u>that</u> lesson when I made a picture frame which turned into a mistake!" laughed Mr. Yamamoto.

"I have even kept that mistake to remind me to measure carefully. Here it is!"



Questions:

a. What did Mr. Yamamoto learn in high school which helped him become a carpenter?

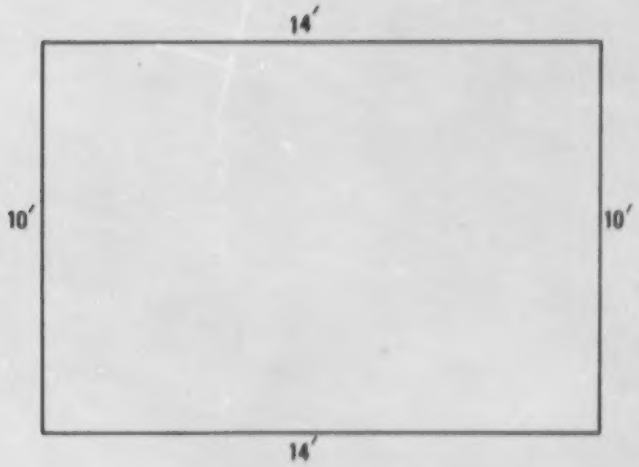
b. What is the perimeter of Mr. Yamamoto's "mistake"?

c. What should the perimeter have been if he had measured more carefully?

3. "Well, you began learning when young. But what did you do after high school?" Juanita wanted to know.

Mr. Yamamoto replied, "After high school I became an apprentice for four years. During those years I had classroom work and on-the-job work to do. I learned how to read blueprints. I learned about building materials and tools. I used what I was learning in real construction jobs and I got paid for this work," Mr. Yamamoto said.

"One of the first things I helped build was a wooden form for a concrete patio. It looked like this." Mr. Yamamoto showed them this drawing.



Questions:

a. As an apprentice, did Mr. Yamamoto learn specific things which helped him become a carpenter? What were these things?

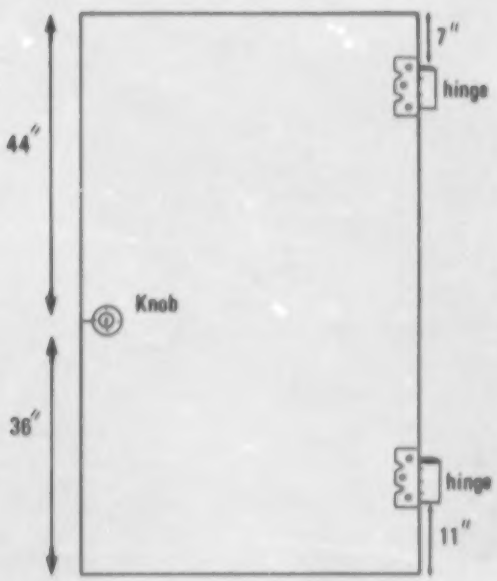
b. What is the perimeter of the patio form he built?

c. What is the area of the patio which was made in this form?

4. "Four years seems like a long time for training. After that, were you a real carpenter?", asked Eddie and Juanita.

"Yes, then I became a journeyman carpenter. Journeyworkers are people who have finished their training. But that doesn't mean they can't learn still more. A person can always learn to do a job better than before," explained Mr. Yamamoto.

"One thing I did learn after I finished my training was that I liked to do some jobs more than others. Now that I have been a carpenter for many years, I do mostly 'finish' work. The 'rough' carpenters put up the frame for the building. When they are done, I do the finish work such as making cabinets, doors, stairways and porches. Here is a plan for a door."



Questions:

a. **Did Mr. Yamamoto learn anything after he finished his training? What?**

b. **If the perimeter of the door is 224 inches, how wide is the door?**

c. Could Mr. Yamamoto have become a good carpenter without training? Why or why not?

d. Do you know of a job you might like to have when you are older?

What kinds of things would you have to learn before you could do the job?

_____

_____

ANSWER KEY

1. a. how to use tools

   the importance of making plans

   b. 25 in.

   c. 38.5 sq. in.

2. a. how to use power tools

   the importance of measuring carefully

   b. 59 ½ in.

   c. 60 in.

3. a. how to read blueprints

   how to use materials and tools

   how to make a form for concrete

   b. 48 feet

   c. 140 sq. ft.

4. a. yes

   how to do his job better

   what kinds of jobs he liked best

   b. 32 in.

   c. no, probably not
   (any reasonable answer should be accepted

   d. any reasonable answer should be accepted

HOME and COMMUNITY

The students may discuss any of the following questions with family members or with neighbors.

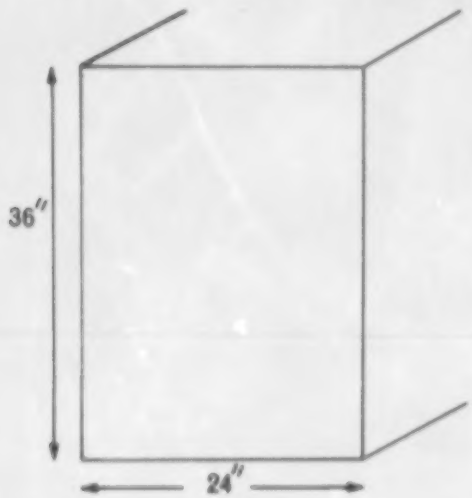
1. What kind of training did you have for your job?
2. Could you do your job without learning anything new?
3. Do you ever need to figure out areas or perimeters on your job? When?
4. Do you ever need to figure out areas or perimeters at home? When?

EVALUATION

1. What is an apprentice?

2. What is a journeyworker?

3. A carpenter is building a kitchen cabinet.



   a. What is the perimeter of the end of the cabinet?

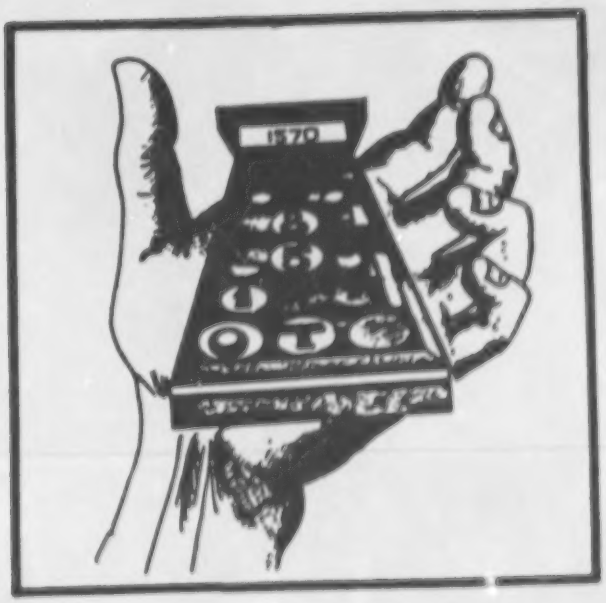
   b. What is the area of the end of the cabinet?

EVALUATION

Answer Key

1. An apprentice is someone who is training for a job. An apprentice has classroom and on-the-job work to do.
2. A journey worker is someone who has finished an apprenticeship.
3. a. 120 in.

   b. 864 sq. in.



COMPONENT II

Section Three

Section Three
Building a Foundation in Math

Learning Objective

Given examples of the jobs done by various workers in the Construction Cluster, the students will determine the areas and perimeter of geometric forms (triangle, square, circle, rectangle, and trapezoid), and they will use these to solve related problems with 80% accuracy.

Key Words

- area
- perimeter
- diameter
- circumference
- construction

Domains and Levels

Cognitive: Knowledge, Application

Affective: Receiving, Responding

Materials

- copies of the narrative for each student

IMPLEMENTATION GUIDELINES

Time: *45 Minutes*

STEP I - State the purpose of the activity:
To learn how people with construction jobs might use math and to practice determining the area and perimeter of geometric figures in order to solve problems which construction workers might have.

STEP II - Read and discuss the Introduction.
If necessary, review the formulas needed for solving the problems.

Area

Rectangle: $A = \ell w$
Square: $A = s^2$
Triangle: $A = \frac{1}{2}bh$

Trapezoid: $A = h \frac{a+b}{2}$

Perimeter

Square: $P = 4s$
Rectangle: $P = 2\ell+2w$
Circle (Circumference): $C = \pi D$ (or $2\pi r$) $\pi = 3.14$

STEP III - Students will solve the problems by working individually.
The teacher will be free to answer questions and to help individual students with problems.

Evaluation

STEP IV - The evaluation is to be completed by students working individually.

STEP V - The Home and Community activity is optional.

STUDENT ACTIVITY MATERIAL

Introduction

There are many different kinds of jobs in construction. Some jobs are for laborers, who work out-of-doors and do heavy, physical work. Other jobs are for people who work in an office and plan buildings on paper. The laborer may need a year of on-the-job training, while the engineer and the architect may need many years of advanced schooling. Still, whether laborers or planners, the people who work in the field of construction have many things in common.

One skill which is needed by many different construction workers is the ability to do math well. The following problems will show you how several construction workers use math to figure out the area and perimeter of geometric figures. Work the problems carefully. You wouldn't like to lose your construction job because you made a math mistake!

Problems

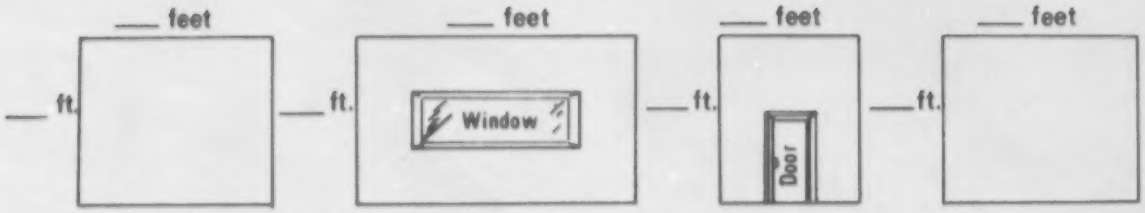
1. A bricklayer is going to make a wall along the back of his yard. The yard is 70 feet wide. The wall will be 4 feet high. It will have an opening 4½ feet wide for a gate.

a. Find the number of square feet in the wall.

b. If it takes 15 bricks per square foot to build an 8-inch thick wall, how many bricks will the bricklayer need?

2. A painter is planning to paint a room which is 18 feet wide and 24 feet long. The walls are 8 feet high.

   a. There are four walls in the room. Write in the dimensions of each wall.



   b. What is the total area of these four rectangles?

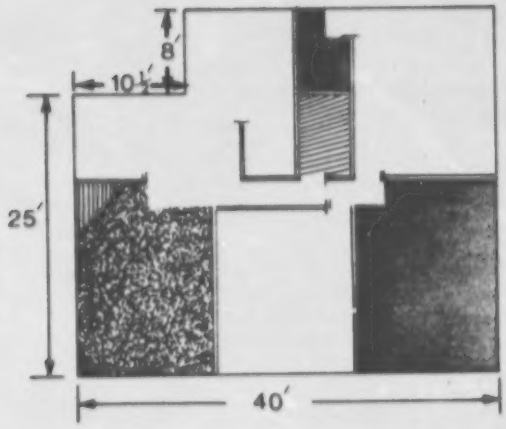
   c. One wall has a door which is 3 feet wide and 6½ feet high. Another wall has a window which is 6 feet wide and 4 feet high. What is the area of the door and the window together?

   d. What is the area of the wall surface in the room? (Subtract the area of the door and window from the total area of the four rectangles.)

   _____ _____ _____

   e. The painter has a gallon of paint. The label says it will cover 400 square feet. Will it be enough to paint the room? _____

3. A contractor is planning to build a new house. The floor plan looks like this:



a. Find the total number of square feet in the house.

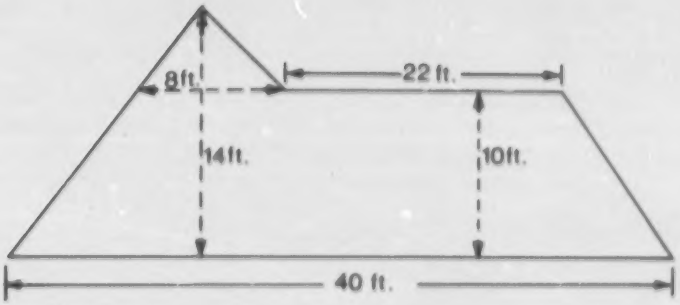
b. If it cost an average of $48.00 per square foot to build a new house, what will be the approximate cost of this house?

4. An electrician is going to put electric outlets in a room which is 17½ feet wide and 21½ feet long. He will put in an outlet every 10 feet.

   a. What is the perimeter of the room?

   b. About how many electric outlets will he need to install?

5. A roofer is going to replace the shingles on part of a roof. The roof is shaped like this.



   a. What is the area of the roof? (Look for a triangle and a trapezoid.)

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b. The roofer will use approximately 4 shingles per square foot. How many shingles will he need?

6. A plumber is going to install some pipes in a kitchen. One pipe must come up through the flooring. A round hole with a circumference of 14 cm has been cut in the floor.

   a. The pipe has a diameter of 4 cm. What is the circumference of the pipe?

   b. Will the pipe fit through the hole? _____ _____

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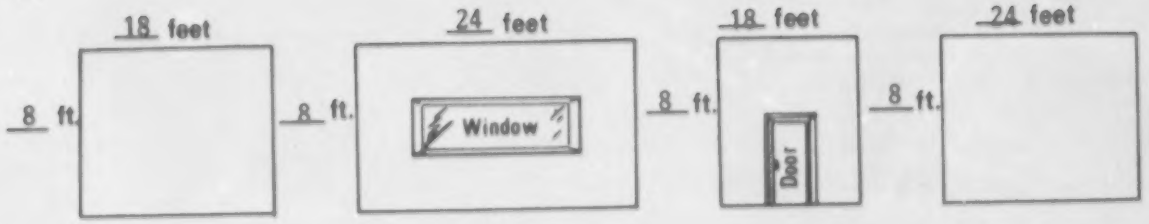
ANSWER KEY

1. a. 262 sq. ft.

   b. 3930 bricks

2. a.



   b. 672 sq. ft.

   c. 43.5 sq. ft.

   d. 628.5 sq. ft.

   e. no

3. a. 1236 sq. ft.

   b. $59,328.

4. a. 78 ft.

   b. 8 outlets

5. a. 366 sq. ft.

   b. 1464 shingles

6. a. 12.56 cm.

   b. yes

HOME and COMMUNITY

Students will measure the rooms in their own homes to determine the perimeter and area of each room;

or

Students will cut out a floor plan from the real estate section of the local newspaper and figure out the area and perimeter of each room. (The Sunday edition frequently has a sampling of floor plans.)

EVALUATION

Evaluation

A floor covering installer is planning to install tile squares on a kitchen floor. The kitchen floor is 11 feet long and 7 feet wide.

1. If each tile square is one square foot in area, how many tiles will be needed?

2. The installer plans to put a border of darker colored tiles around the perimeter of the floor. What is the perimeter of the floor?

3. How many squares will be needed to make this border?
   (Be careful! Each corner square has <u>two</u> sides which touch the perimeter!)

Evaluation Answers

1. 77 tiles
2. 36 feet
3. 32 tiles

Component 3

Section One

Section Two

Section Three

THE WORLD OF MANUFACTURING

Introduction

In this component students will learn the importance of math in jobs found in the Manufacturing Cluster. The purpose of the first section is to motivate students to solve stated problems correctly using the basic operations with fractions, decimals, and percents. This will be accomplished by playing a game which highlights the various kinds of jobs in the manufacturing field. The second section stresses two life skills. The students will learn that technology results in greater, faster, and better production, and they will find the amount of simple interest for one year, given the principal and rate of interest. In the third section, students will have the opportunity to practice the math skill of solving interest problems to find simple interest, principal, rate, and time. These problems will also show the need for math skills in management jobs in the field of manufacturing.

GOALS

MOTIVATION: The students will use basic operations with fractions, decimals, and percents to solve stated problems.

APPLICATION: The students will learn about the role of technology in manufacturing, and they will find the simple interest for one year, given the principal and rate of interest.

ORIENTATION: The students will solve problems for interest, principal, rate, and time.

LEARNING SECTIONS

SECTION 1: The Manufacturing Game

SECTION 2: Butter Making: Then and Now

SECTION 3: Paying the Interest

COMPONENT III
Section One

Section One
The Manufacturing Game

Learning Objective

Given information about job categories in the field of manufacturing, the students will solve stated problems using basic operations with fractions, decimals, and percents, in order to play a game which reinforces the given career information. The students will complete the activity according to the criteria of the teacher.

Key Words

- manufacturing
- management
- technician
- craftsperson
- skilled worker
- semiskilled worker
- unskilled worker
- durable
- nondurable

Domains and Levels

Cognitive: Knowledge, Application

Affective: Receiving, Responding

Materials

- copies of the narrative
- paper and pencil
- one set of factory cards, worker cards, and math cards.

IMPLEMENTATION GUIDELINES

Time: *45 Minutes*

GROUP ACTIVITY

STEP I: State the purpose of the activity:
To learn about jobs in manufacturing and to have fun with a game which will provide practice in solving problems with fractions, decimals, and percents.

STEP II: Read and discuss "The Manufacturing Game."

STEP III: Read and discuss "Playing the Game." Make sure students understand how to play.

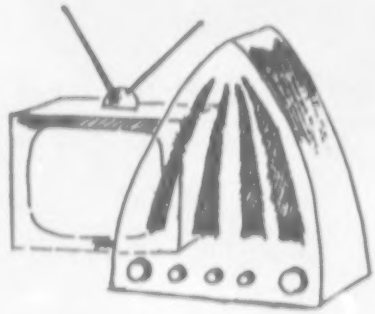
STEP IV: The students will divide into groups of 2 to 4 players. Each group will need a set of 2 to 4 factory cards, 40 worker cards, and 50 math cards. These are to be cut apart from the activity pages. They may be laminated for greater durability. The teacher should be free to answer individual questions. The answer key can be used if students cannot decide the answer to any math problem.

STEP V: The Home and Community activity is optional, to be completed if time permits.

STEP VI: The evaluation is to be completed by students working individually.

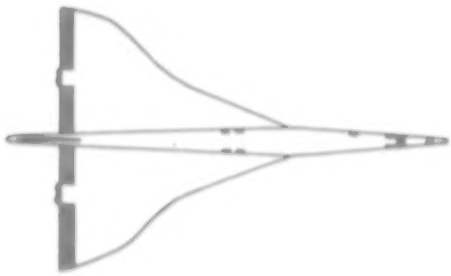
STUDENT ACTIVITY MATERIAL

THE MANUFACTURING GAME



Almost every family has a television set. We turn it on to watch the news at breakfast. We turn it on to see our favorite program at night. We watch sports and detective stories, cartoons and advertisements. We use it all the time. But, do we ever really think about that television? Do we ever wonder where it came from? "From the store," you say. It may have come from a store all right, but where did it come from before that? How was it made? Who made it?

In order to understand how a television is made -- or for that matter, how anything in our homes is made -- we must learn something about manufacturing. The word manufacturing comes from two Latin words: manu, which means by hand, and factus, which means made."* Originally, the word manufacture meant to make something by hand. Today, of course, we also have machinery to help us manufacture things. So, we might say that manufacturing is the process of making products by hand or by machinery.



What kinds of products are manufactured? Just about everything you

*The American Heritage Dictionary of the English Language, 1970.

can imagine, from the tiniest computer component, to the television set, to the largest jet airplane. The products of manufacturing can be classified as durable and nondurable goods. Durable goods are those expected to last a while, such as autos, stoves, or television sets. Nondurable goods, which are used up more quickly, are things such as food, paper napkins, clothing, and medicines.

In order to make all the products which our society needs and wants, the manufacturing industry employs millions of workers. In fact, more people in our country work in the field of manufacturing than any other field. Of course, these people are not all doing the same things. There are thousands of different jobs in manufacturing.

Although it would be impossible to list all the jobs in manufacturing, we can talk about several larger categories of jobs. Each category may have a few or thousands of jobs in it, depending on the size of the manufacturer and on what is being produced. Think again about your television set. No doubt workers from each of the following categories helped to manufacture your television set.

Management

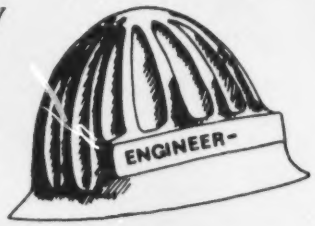
Workers in management are responsible for the administration of the company. The president and the vice president of a manufacturing business have the top jobs in management. The sales officers, clerks, supervisors, and many others also have management jobs.

Scientists

Many manufacturing industries need scientists such as biologists, chemists, and physicists. These scientists do research in many areas. They may work on discovering new and better materials, or they may test sample products for quality and safety.

Engineers

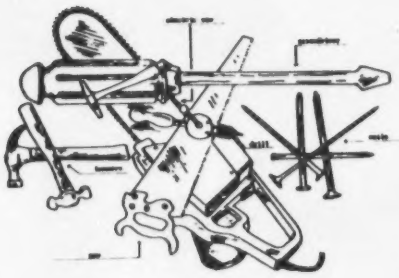
The job of the engineer is to apply scientific information to practical situations. They use scientific knowledge to design products so they are safe and useful. There are many kinds of engineers, such as mechanical, electrical, chemical, and aerospace engineers.



Technicians

The technicians work with the scientists and the engineers to put designs and ideas into action. They need to be able to use complex instruments, and to do mathematics accurately. A few examples are the drafting, computer, electronics, safety, and instrument technicians.

Craftspeople

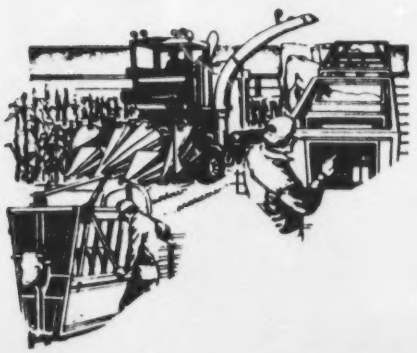


Craftspeople, like the technicians, make the scientists' and engineers' ideas work. They do this by making the tools, instruments, and molds needed to complete the job. The master mechanic, the tool and die maker, the instrument maker, and the tool designer are all craftspeople.

Skilled Workers

Skilled workers are highly-trained to do their jobs. They may make, put together, and operate complex machinery and equipment, or they may use simple hand tools and their own skills to make a product. The engraver, carpenter, printer, and electrician are skilled workers.

Semiskilled Workers



The semiskilled workers are the people who operate the machines which sew, cut, pack, bend, or wrap. These workers do not need as much training as the skilled workers.

Unskilled Workers

Unskilled workers do not need special training for the job. Many of the workers who have unskilled jobs do heavy physical work, such as loading, lifting,

or digging. Other unskilled workers may do lighter work such as filling baskets or putting on labels.

Playing the Game

1. The Manufacturing Game can be played with 2 to 4 players.
2. Each player will need one factory card, paper, and pencil.
3. Each group of players will need a set of worker cards and a set of math cards. These should be shuffled and put in two stacks, face down, before the play begins.
4. The first player will draw one math card and read the problem out loud. All players will work the problem with paper and pencil. The player who read the problem will then announce the answer he or she has. The remaining players will determine whether this is the correct answer by checking their own work.
5. If the math answer is correct, the player will draw one worker card and place it on his or her factory card so that it covers the box with the same worker named on it. The math card will be put on a discard pile.
6. If the math answer is not correct, the player will not be allowed to draw a worker card.
7. The game will continue in like manner, moving clockwise around the circle. Each player will draw a math card, answer it, and draw a worker card if correct.
8. If a player draws a worker card which is the same as one he or she has already placed on the factory card, then this card must be put back. The player will not draw a new worker card until his or her next turn.
9. The winner will be the first player who fills his or her factory card with all the workers needed for that factory.

Variation

To make the game more difficult, one player can be chosen as reader. This player will take a math card and read the problem. The reader will then say "Go," and all players will work the problem. The first player to complete the problem will say "Got it!" If the answer is correct, this player will be the only one to draw a worker card.

Airplane Factory

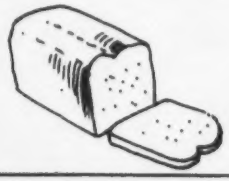
MANAGEMENT	SCIENTIST	ENGINEER
CRAFTSPERSON	ENGINEER	TECHNICIAN
UNSKILLED WORKER	SKILLED WORKER	SEMISKILLED WORKER

Shoe Factory

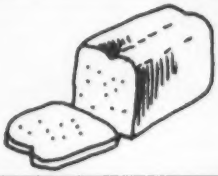
CRAFTSPERSON	SEMISKILLED WORKER	TECHNICIAN
UNSKILLED WORKER	MANAGEMENT	SEMISKILLED WORKER
SKILLED WORKER	CRAFTSPERSON	SCIENTIST

Furniture Factory

UNSKILLED WORKER	MANAGEMENT	CRAFTSPERSON
TECHNICIAN	SKILLED WORKER	TECHNICIAN
SEMISKILLED WORKER	UNSKILLED WORKER	ENGINEER



Bread Factory



SCIENTIST	UNSKILLED WORKER	SKILLED WORKER
ENGINEER	SEMISKILLED WORKER	CRAFTSPERSON
MANAGEMENT	SKILLED WORKER	TECHNICIAN

WORKER CARDS

MANAGEMENT	SCIENTIST
ENGINEER	CRAFTSPERSON
TECHNICIAN	SKILLED WORKER
SEMISKILLED WORKER	UNSKILLED WORKER

WORKER CARDS

MANAGEMENT	SCIENTIST
ENGINEER	CRAFTSPERSON
TECHNICIAN	SKILLED WORKER
SEMISKILLED WORKER	UNSKILLED WORKER

WORKER CARDS

MANAGEMENT	SCIENTIST
ENGINEER	CRAFTSPERSON
TECHNICIAN	SKILLED WORKER
SEMISKILLED WORKER	UNSKILLED WORKER

WORKER CARDS

MANAGEMENT	SCIENTIST
ENGINEER	CRAFTSPERSON
TECHNICIAN	SKILLED WORKER
SEMISKILLED WORKER	UNSKILLED WORKER

WORKER CARDS

MANAGEMENT	SCIENTIST
ENGINEER	CRAFTSPERSON
TECHNICIAN	SKILLED WORKER
SEMISKILLED WORKER	UNSKILLED WORKER

1. A carpenter worked $8^1/_4$ hours on Monday and $7^1/_2$ hours on Tuesday. How many hours did the carpenter work?	10. A welder has joined two pipes which are 6.5 cm and 3.98 cm long. How long is the pipe now?
2. A furniture maker has a board 6 2/3 feet long. He needs a piece 5 1/4 feet long. How much should he cut off?	11. What does $6^1/_2$ divided by $8^1/_2$ equal?
3. A loaf of bread weighs 1 1/2 lb. How much does a carton of 24 loaves weigh?	12. A tester has sampled 200 loaves of bread. One and a half percent were not shaped correctly. How many loaves were not right?
4. What is 25% of $30.00?	13. A skilled worker has done 50% of a job in three days. How many more days are needed to finish the job?
5. A pipe is $8^2/_3$ feet long. If a plumber cuts it in half, how long will each piece be?	14. 90% of what amount is 72?
6. A packer puts 32 cans of vegetables in a box. Each can weighs 482.5 g. How much does the box of cans weigh?	15. Bonus Card Draw a worker card without doing a problem.
7. A scientist has 5.7 l of liquid. She pours it equally into 3 glass beakers. How much liquid is in each?	16. A loader has put 1200 pounds of cans on a truck. 40% of the cans have potatoes in them. How many pounds of potatoes have been loaded?
8. What does 5/6 divided by $2^1/_2$ equal?	17. A pair of shoes costs $11.00 to make. The shoe store will add 50% of this amount to the selling price. How much will the shoes cost?
9. A shoemaker has 6.3 yards of leather. She needs 1.4 for a pair of shoes. How much will be left?	18. An assembler adds one piece to a product every $2^1/_2$ minutes How many pieces are added in an hour?

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19. 2.3432 ÷ 808 = ?	28. You have bought a new shirt for $16.00. It cost the manufacturer 50% of this to make the shirt. How much is the manufacturing going to cost?
20. An engineer has designed a radio which is $22\frac{1}{8}$ cm long. Another engineer has designed one 18 5/6 cm long. How much longer is the first one?	29. What do you get if you add $2\frac{3}{8}$ and $5\frac{6}{7}$?
21. A conveyor belt moves 2 3/4 feet every minute. How far will it move in one hour?	30. Bonus Card Draw a worker card without doing a problem.
22. What does 138.72 divided by 86.7 equal?	31. How much is 40% of $168,000?
23. Three workers are working on a project. Joe has worked 2 $2\frac{1}{2}$ hours; Bill has worked $1\frac{1}{2}$ hours and Sue has worked $5\frac{5}{6}$. How many hours has the project taken?	32. A tool designer makes a tool in two sizes, 14.3 cm and 18.1 cm long. How much longer is the second tool?
24. How much is 5/6 times 2/3?	33. A paper manufacturer puts 200 sheets of paper in each package. It costs 40¢ to make 200 sheets. How much does one sheet cost?
25. The company president has $45,000 to spend on factory improvements. If 35% will be spent on a lunchroom for the workers, how much will be left?	34. What does four divided by one-third equal?
26. An unskilled worker works 8 hours a day. 75% of his time is spent filling baskets. How many hours a day does he spend filling baskets?	35. 2.67 + 3.99 = ?
27. A factory has a yearly budget of $250,000. $150,00 is spent on salaries. What percentage is spent on salaries?	36. A baker uses 3.8 kg of flour for each batch of bread. He made 8 batches. How many kg of flour has he used?

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37. A television set weighs 48.5 pounds. The box it goes in weighs 4.8 pounds. How much do they weigh together?	46. A pair of shoes weighs $3\frac{6}{10}$ pounds. The shoe box weighs 1/3 pound. How much do the shoes in the box weigh?
38. A technician worked $8\frac{1}{2}$ hours a day for 5 days. How many hours did he work?	47. What do you get if you multiply 8.70 by 6.31?
39. 80 is 20% of what?	48. A furniture factory makes 148,000 sofas a year. Thirty percent of these are sofa beds. How many sofa beds are made each year?
40. A clothing maker has material which is 13 7/8 yd. long. If he cuts it into 3 pieces, how long will each piece be?	49. How much is 10 minus 3.3?
41. A skilled worker assembles chairs. Each chair weighs $56\frac{1}{2}$ pounds. How much do 340 chairs weigh?	50. A skilled worker can paint $4\frac{1}{4}$ chairs per hour. How many chairs can be painted in an 8 hour work day?
42. Bonus Card Draw a worker card without doing a problem.	
43. 4/5 - 1/4 = ?	
44. A worker strings beads in a necklace factory. Each bead is 3/8 inch long. If there are 92 beads per necklace, how long is each necklace?	
45. A welder has put together two pipes which are 1 1/2 feet and 2 2/5 feet long. How long is the pipe now?	

ANSWER KEY TO "THE MANUFACTURING GAME"

1. 15 3/4 hr.
2. 1 5/12 ft.
3. 36 lb.
4. $7.50
5. 4 1/3 ft.
6. 15,440 g (15.44 kg)
7. 1.9 l
8. 1/3
9. 4.9 yd.
10. 10.48 cm
11. 13/17
12. 3 loaves
13. 3 days
14. 80
15. Bonus
16. 480 lbs.
17. $16.50
18. 24
19. 2.9
20. 3 7/24 cm
21. 165 ft.
22. 1.6
23. 9 5/6 hr.
24. 5/9
25. $29,250.00
26. 6 hrs.
27. 60%
28. $8.00
29. 8 13/56
30. Bonus
31. $67,200.00
32. 3.8 cm
33. .2¢ (1/5¢)
34. 12
35. 6.66
36. 30.4 kg
37. 53.3 lb.
38. 42 1/2 hrs.
39. 400
40. 4 5/8 yrd.
41. 19,210 lb.
42. Bonus
43. 11/20
44. 34 1/2 in.
45. 3 9/10 ft.
46. 3 14/15 lb.
47. 54.897
48. 44,400
49. 6.7
50. 34

HOME and COMMUNITY

Students may ask family members and neighbors if they have jobs in manufacturing. If so, they should try to determine in what job category the person's job falls, such as management, craftsperson, skilled worker, and so on.

EVALUATION

1. Name at least three kinds of workers needed in manufacturing.

   _____

   _____

   _____

2. What does the word manufacture mean?

   _____

3. Do these problems:

   a. 1/3 + 5/8

   b. .08 - .0132

   c. 2 3/4 x 1 1/3

   d. 15% of $ $28.00 =

   e. 48.5 + 36.9

   f. 3 ÷ 1/8

ANSWER KEY

1. Management, scientist, technician, craftsperson, skilled worker, unskilled worker, semiskilled worker, engineer

2. Manufacture means to make by hand or machinery.

3. a. 23/24
   b. .0668
   c. 3 2/3
   d. $4.20
   e. 85.4
   f. 24

COMPONENT III

Section Two

Section Two
Butter Making: Then and Now

Learning Objective

Given a description of past and present methods of manufacturing butter, the students will understand that technology results in greater, faster, and better production. Students will also find the amount of simple interest for one year, given the principal and rate of interest, with 80% accuracy.

Key Words

- interest
- rate
- principal
- technology
- production

Domains and Levels

Cognitive: Knowledge, Application

Affective: Valuing

Materials

- copies of the narrative
- evaluation

IMPLEMENTATION GUIDELINES

Time: *45 minutes*

Note: Two life skills which will be useful to students are stressed in this activity. First, the students will learn that technology results in greater, better, and faster production. Secondly, the students will practice figuring simple interest for one year, given the principal and rate of interest.

Group or Individual Activity

STEP I: State the purpose of the activity:
to learn about the changes technology have brought to the field of manufacturing, and to practice computing simple interest.

STEP II: This activity may be presented in several ways.

a. The teacher may read aloud, or have a student read aloud, the narrative sections. Students will discuss the answers to the questions as they appear in the narrative.

b. The teacher may have oral reading and discussion of the narrative entitled "Then and Now." Students may then be asked to work the math problems individually.

c. The entire activity may be done by students reading and working individually.

STEP III: The evaluation is to be completed by students working individually.

STEP IV: The Home and Community activity is optional, to be completed if time permits.

STUDENT ACTIVITY MATERIAL

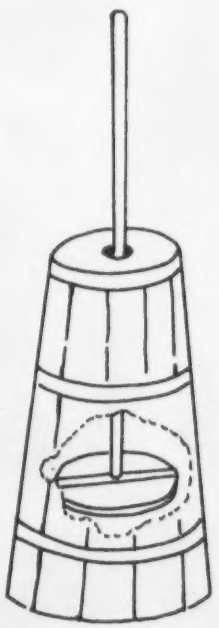
"BUTTER MAKING: THEN AND NOW"*

Then ---

The year was 1845. Thaddeus McCoy and his wife Sarah had just gotten out of bed. It was 4:30 a.m., and Thaddeus had to hurry out to the barn to milk Bossie, the cow. When Thaddeus came in with the milk, Sarah set some of it aside so the cream could rise to the top. She would need the cream to make butter. Later that evening, Sarah skimmed the cream off the top of the milk and put it in a crock. At 9:00 Thaddeus blew out the candle. It was time to rest.

The next morning, Thaddeus warmed the cream up to about 70° so it could ripen. Several hours later, Thaddeus got the wooden churn ready by cleaning it with boiling water. Then he rinsed it with cool water so the butter would not stick.

Now Sarah got to work. It would take her twenty to thirty minutes of work, moving the dasher up and down, before the cream would begin to form little kernels of butter.

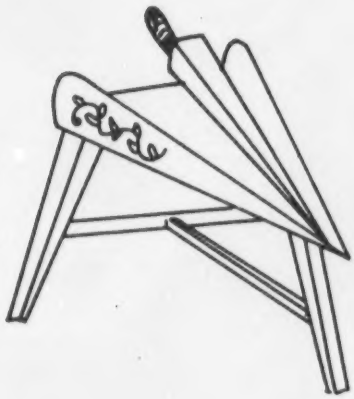


CHURN

When the butter was ready, Sarah took it out of the churn and rinsed it.

*For more detail on butter making, see How Do They Make It?, George Sullivan, The Westminster Press, 1965.

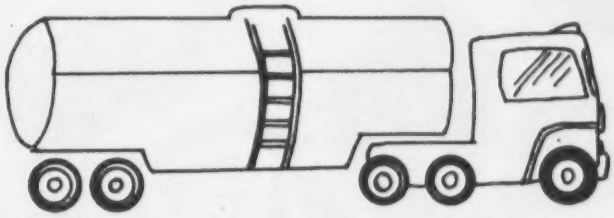
Sarah was not finished. She now put the butter into a flat butter worker. She salted the butter and then pressed the butter flat with a lever. Next she folded the butter over and again flattened it out. Sarah continued this process until the butter was smooth and evenly salted.



While Sarah wrapped the butter up tightly and put it out in the spring house, Thaddeus scrubbed the churn and the butter worker.

The McCoys would have fresh butter for supper, and tomorrow Sarah would sell the rest at the market.

Now ---



The year is 1980. George McCoy, the great-great-grandson of Thaddeus McCoy, is just getting out of bed. It is 6:30 a.m., and he needs to get dressed, eat breakfast, and drive to work.

At 8:00 George arrives at the Sunshine Creamery. The Sunshine Creamery is a large manufacturer of dairy products. It has divisions for cheese

making, milk bottling, and butter making. George is the manager of the butter making division.

During the morning, George takes a school class on a tour of the butter-making division. First, he takes the students outside where they see large tank trucks. These trucks collect the milk from the diary farms and bring it to the creamery, where it is pumped into the plant. The milk is then inspected and filtered so that it contains no dirt.

Next, the students are shown where the cream is separated from the milk. Only milk which contains 30 to 35% butterfat is used. This milk is put into large rotators which spin the milk at a high speed so the cream is separated. This cream is then pasteurized by heating it to 145° for thirty minutes, and then quickly cooling it to 35°. After pasteurization, no bacteria remains in the cream.

George shows the students the churns next. These churns, made of shiny aluminum, are large enough to process from 1,500 to 5,000 pounds of butter at one time! The butter is churned for about half an hour. Then the buttermilk is removed, the butter is salted, and the salt is worked into the butter by machine.

Before the butter is packaged, it must be tested and graded. The butter is graded for color, flavor, and amount of salt. Only the very best butter can be called Grade AA.

Finally the butter is moved along on a conveyer belt to the packaging department. Here it is packed into boxes which hold sixty pounds of butter. It will now be sent to a distributor, who will divide it into quarter pound sticks and wrap it for sale in one-pound boxes. 135

Before the students leave, George tells them, "My great-great-great-grandmother used to have to make butter twice a week in a wooden churn. Today, modern technology has provided us with the machinery to produce butter more quickly, efficiently, and in larger quantities. The butter is of a more consistent quality, too. Would you like to taste some?"

Questions to Consider---

1. What differences are there in the butter making process of long ago and of today? _____

   _____

2. What part has technology played in changing the way butter is made?

   _____

3. Can you think of other products which were made by hand in the past and which are now made with the help of modern technology?

   _____

   _____

An Interest in Butter —

As you can see, the basic process for making butter has remained the same — you separate the cream, you churn the cream, and you work the butter — even though the machinery for doing this work has changed enormously over the years. There are other aspects of life long ago and life today which also remain the same.

One unchanged feature of life is the fact that the money is needed to buy things. Sometimes in the past goods were exchanged for other goods. Still, the principle remained the same. You couldn't get something for free.

Suppose a person doesn't have enough money to buy things. Then, that person might decide to borrow money and pay it back later. Of course, borrowing money is not free, either. The borrower must pay back the money, with interest, to the lender. Let's once again visit the McCoys, both then and now. We will see how they might borrow money.

Math Questions to Answer ---

Then

1. Sarah McCoy's churn was all worn out. She needed a new one right away, but the McCoys would not have any money until the end of harvest. Sarah borrowed $1.80 to pay for the churn. After one year she paid it back with 3% interest.

   a. How much was the principal?

   b. How much was the interest Sarah paid after one year? (Round off to the nearest cent.)

   c. What was the total amount, principal and interest, which Sarah paid for the churn?

2. Thaddeus wanted Sarah to make more money by selling butter. He decided to buy another cow so Sarah could double her butter money. Thaddeus decided to borrow the money and pay it back later with butter-selling money. Thaddeus borrowed $45.00 for one year to buy the cow. He agreed to pay 2½% interest.

   a. How much was the principal?

   b. How much interest did Thaddeus pay after one year? (Round to the nearest cent.)

c. What was the total amount, principal and interest, which Thaddeus paid for the cow?

Now

3. George McCoy wants to replace some outdated machinery in the butter making divisions of the Sunshine Creamery. He will have to borrow $35,000 to buy the equipment.

   a. How much interest will George pay for one year if the rate of interest is 12%?

   b. How much interest will George pay for one year if he must borrow at the higher rate of 15%?

4. George also needs to buy a new tank truck for the creamery to use. The tractor section of the truck will cost $45,000. The tank and trailer section will cost $50,000.

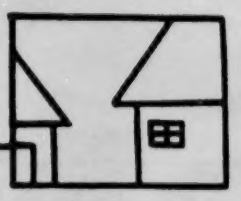
   a. If George decides to borrow the entire amount for one year, at a rate of 13% interest, how much interest will he pay?

   b. If George decides to borrow only the amount needed for the tank and trailer section, for one year at 12% interest, how much interest will he pay?

ANSWER KEY, NARRATIVE

1. a. $1.80
   b. $ .05
   c. $1.85
2. a. $45.00
   b. $1.13
   c. $46.13
3. a. $4,200.00
   b. $5,250.00
4. a. $12,350.00
   b. $ 6,000.00

HOME and COMMUNITY



The students will find advertisements in newspapers of magazines for five products, such as clothing or radios, which they would like to buy. This can be done at home or in the library. Students will then pretend to borrow money to purchase the goods, and fill in the following chart.

Item	Cost	Principal Loan	Time	Interest		
				Rate 10%	Rate 15%	Rate 20%
1.			1 yr.			
2.			1 yr.			
3.			1 yr.			
4.			1 yr.			
5.			1 yr.			

EVALUATION

EVALUATION

1. How has technology changed the production of many manufactured goods?

   _____

2. Find the interest for one year.
   a. $900 at 12%
   b. $580 at 18%
   c. $1,200 at 6½%
   d. $635 at 9%

Answer Key

1. With technology, goods can be manufactured more quickly and in larger amounts.
2. a. $108.00
   b. $104.40
   c. $ 57.00
   d. $ 57.15

COMPONENT III

Section Three

Section Three
Paying the Interest

Learning Objective

Given an account of three people who have management jobs in the Manufacturing Cluster, the students will solve interest problems for simple interest, principal, rate, and time, with 75% accuracy.

Key Words

- management
- manufacturing
- interest
- principal
- rate
- time

Domains and Levels

Cognitive: Knowledge, Application

Affective: Reception, Response

Materials

- copies of the narrative
- evaluation

IMPLEMENTATION GUIDELINES

Time: *45 Minutes*

STEP I: State the purpose of the activity:
To learn how people with management jobs in manufacturing make decisions about borrowing money, and to solve interest problems.

STEP II: Read and discuss the introductory section of the narrative, "Paying the Interest." If necessary, review the formula for solving interest problems:

$$I = P \times r \times t$$

STEP III: The teacher may wish to explain that the problem in this activity will show only simple interest. The students should know when they actually save money in a credit union, they will earn compound interest, so that the interest they earn will also begin to earn interest. Students should also know that when a loan is paid off in installments, the principal is reduced, thus reducing the interest.

STEP IV: Students will solve the problems by working individually. The teacher will be free to answer questions, and to help students who may have difficulty reading the problems.

STEP V: The evaluation is to be done by students working individually.

STEP VI: The Home and Community activity is optional, to be completed if time permits.

STUDENT ACTIVITY MATERIAL

PAYING THE INTEREST

Introduction

In the manufacturing business, people who hold jobs in management are very important. The job of management is to be in charge of day-to-day operations, and also to be looking ahead to the future. It is the people in management who decide what products will be made, what machinery will be bought and used, and what changes should be made so that the company can manufacture its product more efficiently.

The goal of any manufacturer is to make a product. Then, the product is sold for more than the labor and materials cost to produce it. This is called making a profit. Some of the biggest decisions made by people in management are those involving money and profits. It takes money to begin a manufacturing business. It takes money to purchase the materials needed for manufacturing. It also takes money to pay all the workers whose skills are used in manufacturing the product.

Sometimes, people in management decide to borrow the money needed. Then, when the product is finished, it will be sold for a profit. The only way a profit can be made is by selling the product for enough money to pay back the loan with interest, to pay the workers, and still to have some money left over.

Let's take a look at the work of several people who have management jobs in manufacturing. We will see that they must know all about borrowing money and paying the interest.

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Problems

1. Lou Rice is the corporate treasurer of a very large manufacturing business. His company manufactures electronic equipment. It is Lou's job to decide when money will be borrowed by the company. Sometimes he decides that the company should borrow huge amounts of money. Other times, the amount to be borrowed is smaller.

   a. Lou's company is planning to build a new plant. The modern machinery in this new plant will manufacture the product more quickly. The profits will then increase. The total cost to build the plant and purchase all the machinery needed is $30,000,000. Lou has decided the company should borrow $10,000,000, at a rate of 12% interest, to be paid back in five years.

   Fill in the table and figure out how much interest the company will pay on the loan if the loan is paid back at the end of five years.

Principal	
Rate	
Time	
Interest	
Total Amount to Be Repaid	

b. Sometimes Lou makes decisions on smaller loans. For example, his company may need to borrow money to pay for the materials used in manufacturing the product. Often these loans are repaid in a short time. Suppose Lou's company borrows $5,000, at a rate of 10% interest, to buy materials. The loan is paid back in one month. Fill in the table and find the interest paid on this loan.

Principal	
Rate	
Time	1/12
Interest	
Total Amount to Be Repaid	

c. Besides buying $5,000 worth of materials, Lou's company will spend $1,000 on labor to make this product. If the product is sold for $7,500, how much profit will the company make?
(Don't forget to add the interest paid to the cost of manufacturing the product.)

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2. Gloria Caro is the president of a brand-new manufacturing company. Her company will manufacture baskets. In order to begin the business, Gloria must buy $150,000 worth of equipment. As president, Gloria must decide what kind of loan to get.

   a. Gloria can choose to borrow the money at several different interest rates, and for different lengths of time. This table shows the different loans.

      Complete the table to find out how much interest would be paid for each kind of loan.

	Loan A	Loan B	Loan C	Loan D
Principal	$150,000	$150,000	$150,000	$150,000
Rate	10½%	12%	13%	10%
Time	3 yr.	5 yr.	7 yr.	1 yr.
Interest				
Total Amount to be Repaid				

   b. Which loan would Gloria choose in order to pay the least interest?

150

3. The Balboa Company manufactures boats. It is a large company with 12,000 people working for it. The Balboa Company has a credit union which its employees can use. A credit union is like a bank in some ways, because people can save money and borrow money from the credit union.

Mary Martinez is the manager of the Balboa Credit Union. She encourages the Balboa employees to save money. The money saved will earn interest. Mary explains that the amount of money saved, the rate of interest, and the time the money remains in the credit union will determine how much interest is earned.

Fill in the following table for the missing information.

	A	B	C	D
Amount Saved (Principal)	$500		$1,000	$750
Rate	6½%	5%	10%	
Time	1 yr.	2 yr.		5 yr.
Interest Earned		$50	$100	$187.50

ANSWER KEY, NARRATIVE

1. a. Principal $10,000,000
   Rate 12%
   Time 5 yrs.
   Interest $6,000,000
   Total $16,000,000

   b. Principal $5,000
   Rate 10%
   Time 1/12
   Interest $41.67
   Total $5,041.67

   c. $1,458.33

2. a.

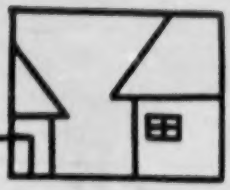
	Loan A	Loan B	Loan C	Loan D
Principal	$150,000	$150,000	$150,000	$150,000
Rate	10½%	12%	13%	10%
Time	3 yr.	5 yr.	7 yr.	1 yr.
Interest	$47,250	$90,000	$136,500	$15,000
Total	$197,250	$240,000	$286,000	$165,000

   b. Loan D.

3.

	A	B	C	D
Amount Saved	$500	$500	$1000	$750
Rate	6½%	5%	10%	5%
Time	1 yr.	2 yr.	1 yr.	5 yr.
Interest	$31.25	$50	$100	$187.50

HOME and COMMUNITY



Students may ask family members any or all of the following questions.

1. Do you have any loans which you must repay, such as a house mortgage?

2. What interest rate do you pay on this loan? What is the time period of the loan?

3. Do you have a savings account in a bank or credit union?

4. What interest rate does your bank or credit union give on your savings?

EVALUATION

EVALUATION

1. What are some of the duties of people who have management jobs in the field of manufacturing? _____

_____

2. Complete the table.

Principal	$500	$300	$200	$700
Rate	8%	6%		12%
Time	5 yr.		2 yr.	4 yr.
Interest		$72	$40	
Amount to be Repaid				

ANSWER KEY

1. Oversee day-to-day operations; decide what products will be made; decide on machinery to be bought; plan for the future; etc.

2.

Principal	$500	$300	$200	$700
Rate	8%	6%	10%	12%
Time	5 yr.	4 yr.	2 yr.	4 yr.
Interest	$200	$72	$40	$336
Total	$700	$372	$240	$1036